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# Compulsory Unemployment Insurance and its Effect on the Machinery Industry

## Manufacturers in Two States Facing Compulsory Unemployment Insurance—Humanitarianism Ignores Economic Laws—Inelastic Demand a Factor in Machinery Industry

By ERNEST F. DuBRUL
General Manager, National Machine Tool Builders' Association

THE industries of Massachusetts and Wisconsin face agitation advocated by people who have a very worthy desire to improve the conditions of wage earners. Unfortunately, such sentiment often takes on an impractical character, as in the advocacy of unemployment insurance in the two states named. No doubt such legislation will be presented in other states during the coming year. It is well, therefore, for manufacturers to be fortified with arguments against such legislation, and the following is submitted for your information to be used whenever the occasion arises.

The bills now being agitated in the states of Wisconsin and Massachusetts would be absolutely disastrous to the machinery industries of those states for a very fundamental economic reason: That is, that the demand for machinery is of a most inelastic character. These bills in effect provide that, if, after a workman has been employed for a given length of time, he be laid off through no fault of his own, an unemployment dole or compensation shall be paid to him for another period of time.

Let us see how this affects the machine building industries. Machines have absolutely no demand in and of themselves. Theirs is a derived demand, that arises only when there is a market for the products of the machines, though increased material comfort obtained by increased consumption of material goods is possible only by the increased use of machinery. No industry can, for very long, produce more goods than it can sell, whether its force be 5 or 5,000 men, and whether its product be special and made on contract, or be of such a nature that it can be made for stock. A shop working on special or contract machinery gives the clearest illustration of the principle involved.

Unemployment is mostly due to the operations of the economic cycle, and the evils of unemployment are more apparent in times of depression than at any other time. This accounts for the attempts in such periods to mitigate the evils by legislation. Such times of depression are also financially the most dangerous for the employer. Therefore, the proponents of unemployment insurance propose to compel the employer to pay out unemployment doles just when he can least afford to do so, and when such doles would further drain his cash resources, already more than sufficiently burdened from various other causes.

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An employer making contract machine work has no alternative when general business slumps but to lay off his men. He cannot possibly find employment in such times for all the men he had used when his business was good. He does not lay them off for caprice; he wants to get work for them and for his shop as well. To compel such an employer to pay wages or any percentage of wages to the men previously employed, would compel him to pay out money without any possibility of receiving any return therefor. Could he possibly make his price on the product sold during active times high enough to include the paying of unemployment doles to the men who might be discharged immediately on completion of a certain job? The tremendous addition in cost that would have to be made in all estimates to cover these contingencies would result in such inflation in prices as to prevent exchange. Could any employer possibly get any mathematical basis of experience on which to base any such estimates?

A favorite argument of the proponents of unemployment compensation is that it would compel the employer to continue employment and make goods for stock. Consider two machine builders making an equivalent line of machinery.

In one case as the demand falls off after a boom has passed, the management ceases production as order-

are filled. Even so, there will surely be some outstanding orders for materials, orders that had to be placed far ahead, in anticipation of delays in delivery of materials, to permit a continuing schedule of manufacturing. These "Impending Inventories" so-called, are always of larger dollar value than the current requirements of a dull period. The orders must be placed ahead for larger quantities than would be the case were deliveries prompt. Then, as soon as deliveries improve with the fall in demand, these inventories come in on the manufacturer. Often the rush is great enough to swamp many concerns who have not been sufficiently careful to avoid over-ordering of this sort. Even the best forecaster is sure to get stuck with some inventories of that kind, and they are always high priced. Even though the cash position is very sound and provides enough to carry the key organization over the slump with the reduced demand, the fall in price on the components of the material inventory is a dead loss on what has to be carried.

Adding to his natural and unavoidable burdens, the unemployment insurance law would compel this employer to pay out additional amounts of cash as unemployment compensation to the men laid off. No concern could do so unless it had charged enough more for its product during the boom to provide that cash when it was needed, the amount depending on the provisions of the law, of course. And if it did so it would be called a profiteer by the uninformed sentimentalists.

### Working Up Large Inventories

Now, suppose that a direct competitor of this concern were to continue production and work up these inventories in order to give his men employment. He would deplete his bank account of the cash he would invest in the additional labor, of course. As he continued, his warehouses would fill up with machines built at high costs for labor and material, machines that would later on find themselves in competition with low cost machines built by the wiser competitor who had shut down when the boom passed. If the depression lasts long enough even this employer must shut down for lack of cash, for due to the nature of demand for machinery his stock is very slow moving.

If, in addition to what he spent for labor in working up stock, his cash account is to be drained by the additional unemployment dole his position is still further weakened. More than that, the competitor who first shut down will be in better position to re-employ good men at lower wages as soon as demand shows signs of revival. He then will get the pick of the labor market, including the best men laid off by the man who overstocked. All this will make for lower costs and lower prices, and still greater loss to the one who continued employment.

As it would be doubly disastrous to continue employment for that reason, there is no sane basis for the argument that by compelling employers to pay unemployment insurance they will be compelled to keep men employed.

### Effect of Obsolescence of Product

The history of every depression shows that precisely in such times are improvements mostly made in machine designs. This is perfectly natural, for two reasons: First, because the machine builder has more time to think in periods of that sort, when the pressure of production is relieved; and second, because the pressure of competition and the necessity of getting business drives him to coax every possible bit of business his way by bringing out newer and better machines.

The competitor who was wise enough to shut off his production early is probably fully fortified with new designs, ready to be brought out when the market is down. If a design is very far in advance of previous practice, that new design simply wipes out the potential value of the stock of older types of machines left on the hands of any producer. This makes over-stocking particularly disastrous to the machine builder. The relative value of old types of machines will not be at all in accordance even with the replacement cost. It will accord with the relative utility of such machines in production of the goods they were designed to make. Obsolescence loss due to over-stocking is an ever present and very large danger to machine builders in every depression. This danger makes it all the more imperative for them to shut down until cost conditions are stabilized at lower levels.

Machine builders naturally have a bad "load factor" and the effect of their load factor must be carefully considered before legislation of this sort is allowed to pass.

### Consumer and Producer Goods

Some advocates of unemployment doles are college professors, not producers of physical goods. As consumers they seem to view production as mainly the production of consumer goods. As a matter of fact, the great mass of production is production of producer goods; that is, goods used for further production, or processing.

Only a very small part of the production of any one year goes into consumption that year. The most elastic demands are those for consumer goods of perishable nature. Even the perishable consumer articles have a varying elasticity in their demand according to the varying conditions of the purchasing power of the country and according to the psychological attitude which in some cyclical stages diminishes the will-to-buy even though the power-to-buy is present.

Relatively small reductions in price of some commodities would correspondingly widen the market and restore the unit demand. But even in such cases it is necessary for the manufacturer to keep his costs going down in line with reduced prices, if he is to make a profit. That means that he must get more output per dollar of wages paid, either by getting more production per dollar or by reducing wage rates.

Theoretically he might sell the market short from day to day or week to week and get his costs down below the sale price—if he cannot increase output.

### Evil Effects of Unemployment Insurance Laws

If his shop is full of orders his workmen will not accept a reduction of wages. In his present stage of economic education the wage earner cannot recognize the necessity and desirability of accepting progressive cuts in wages that would bring down costs in conformity with prices. The inevitable consequence of wage cuts so made is to breed strikes, with their usual manifestations, without reducing wages. He finds it difficult to reduce wages without stopping production.

If unemployment insurance laws were in effect, and an employer sought to reduce cost by reducing wages, and keeping the shop full of orders taken at lower

prices, such an employer would surely be accused of cutting wages to bring on a strike and thereby avoid the payment of unemployment compensation. For this reason also, the unemployment dole would not work out in practice to continue employment, even in industries having an elastic demand, that would respond to lower prices.

In England experience with unemployment doles shows that many workers preferred to lie idle and amuse themselves, as long as the small dole was forthcoming, rather than to hunt a fresh demand for their services at reduced pay on the new job. In such cases, the unemployment dole increased unemployment and did not reduce it.

If, through misguided sentiment, the states of Wisconsin and Massachusetts should be burdened with this sort of legislation, the machine industries of those states will experience many relative difficulties in competition with employers of other states, unless and until similar economic fallacies and misguided sentiment would procure the passage of similar bills in other states. Meanwhile, the machine builders in Wisconsin and Massachusetts would be greatly weakened and many of them no doubt would be put out of business by the conditions created by the worthy desire to mitigate the evils of unemployment.

Bradstreet's statistics of failures show that the metal working industries have had the worst experience of all the manufacturing industries. Certainly to add unemployment doles to their other burdens would put more concerns out of business than the present bad conditions have done. Could the social loss and wastage of capital caused by the wrecking of businesses that offer employment, offset the doles that would be paid to the employees that would be supposed to be protected by the unemployment insurance?

### Scientific Insurance Impossible

The worst thing about some of these bills is that they seek to put the burden of the unemployment dole directly on each employer, instead of providing some scientific insurance basis on which to calculate the risks. These bills are general, and apply to all industries alike, regardless of the fact that the demand for the product of each industry is entirely different in its nature and in the effect its elasticity must exercise on wise managerial policy. To provide scientific insurance, on an actuarial basis, that would make each industry carry its fair share of burden would be an almost impossible task. No man can possibly vision a fair basis of that sort, because human caprice shifts demand over night. There have been times when factories making articles of wearing apparel like bustles, beads, and hoop-skirts, have found the decrees of fashion to wipe out their demand over night, and the workers had to hunt for other jobs, and so did the factory. How could any actuary devise a formula that would furnish a scientific insurance basis for unemployment compensation in such cases?

Nearly every producer must gamble more or less on his judgment of the consumer's taste, to tempt the consumer to part with money in exchange for his own commodity. This is a heavy enough risk without adding to it the additional burden of paying out doles that in England encouraged idleness, while the employer himself has to hunt a job through change in demand, and may face bankruptcy besides.

### An Economic "Sport"

No legislator, no social reformer, no matter how sincere, can afford to make the burdens of industry more than they are now. Advocates of all sorts of social legislation are indulging in the favorite economic sport of hounding the manufacturer. They cannot believe that the hated employer must conform to the operations of the business cycle if he would stay *in* business and give employment and produce goods to supply the wants even of the reformers, to say nothing of paying taxes, like the Excess Profits Tax, that penalized progress. Many such people cannot be made to realize that employment can be continuous only as business is healthy. Too many, through ignorance or envy, look on profit as an exploitation of the manual worker. They cannot believe that after all the losses of all industry are taken up over a long period of time, the final remainder left, if proportionately distributed to all the business men in the industry, would be a small per capita reward for their organizing ability and their courage in taking the risks out of which the small net profit arose.

True, some men do get big rewards, but they are very few and far between—"For many run, indeed, but only one gains the prize." It is precisely that human hope or optimism that tempts so many to run in spite of the fact that only a few can and do succeed. Kill that hope, and society will never progress. Russia's example should be enough for memory. Each individual, whether worker or employer, has his own part to look after in earning the world's living, and he can only exchange his own commodities or services for those of others.

Insurance as a science can never insure things that lie so much in the domain of politics, so influenced by feelings and emotions, as the unemployment question.

To ask the individual to do what cannot be done by scientific insurance is asking the impossible.

# Unemployment—A Management Problem

## Basis for Public Insurance Not Yet Developed in United States—European Systems Grew Out of Private Efforts

THE basis for applying public insurance to the relief or prevention of unemployment in the United States without enormous cost does not exist as yet, according to a study of the question just issued by the National Industrial Conference Board, under the title "Unemployment Insurance in Theory and Practice." This basis has been provided in European countries where such insurance is in use, by fairly definite knowledge of the rate of unemployment and its stabilization and reduction through the efforts of workers and employers. In the United States, where the rate of unemployment is normally more than twice as high as in Europe, where little accurate knowledge exists regarding it, where private organization and activities in relation to unemployment have not developed to any great degree, and where the great extent and political organization of the country would make the administration of legislation difficult and costly, the problem invites the voluntary co-operative effort of industry and the public before compulsory legislation is resorted to.

### Summary of the Report

According to the theory of insurance, the economic application of the insurance principle to unemployment requires: (1) That the risk of unemployment for the group covered be relatively constant, definitely determinable and reduced to a minimum; (2) that the cost, when determined on the basis of a constant risk arising from causes beyond the control of the worker, be distributed so as to give an incentive for its further reduction.

The problem of unemployment insurance from a practical point of view, therefore, is one of deciding whether the unemployment contingency may be more definitely prevented and provided for at less cost and with more equitable distribution of the burden by means of public insurance than through some other form of co-operative effort toward prevention or relief. This involves the specific questions regarding the extent to which other forms of co-operative relief or prevention are available; to what extent it is possible to determine, stabilize and reduce the average risk; and to what extent the direct costs and benefits can be distributed so as to be equitable and so as to tend toward a reduction of the contingency.

The development of co-operative unemployment relief and prevention measures in all countries where such measures have been tried indicate: (1) That they have grown up in correspondence with an increase in the frequency and seriousness of unemployment, with the recognition of the inadequacy of individual provision for relief and an increasing sense of social responsibility; (2) that the private co-operative measures have served as a basis for social measures; (3) that these private measures have become insurance measures to the extent that the cost could be diminished, through reducing, stabilizing and determining the risk; (4) that public or social insurance systems have been developed out of private insurance measures so far as the latter have proven inadequate or excessively costly from the insurance point of view and so far as the sense of social responsibility has led society to assume part or all of the burden and distribute it over certain groups; and (5) that, finally, these social insurance measures have proven successful from the insurance point of view to the extent that their cost has been diminished by limiting their scope and determining, stabilizing and reducing the risk through assisting private co-operative efforts, through basing their actuarial features on the experience with these private efforts and supplementing them by special measures such as labor exchanges.

### Co-operative Benefit Funds

The voluntary co-operative measures such as trade union benefit funds and friendly society aid have been accepted for many years in England and certain other countries of Europe as a means of meeting unemployment contingencies, but they have not developed to any great extent in the United States. The advantages of such systems of mutual aid are that they spring from the voluntary initiative of groups of workers, whose risk of unemployment is approximately equal, and that within a narrow area they may serve to reduce unemployment and malingering. They fail generally because of the relatively small number of workmen reached because they afford no incentive to industrial forces which might assist in improving employment conditions, because the field for placing members out of work is limited, and finally, because their cost is relatively high and their financial or contractual basis insecure.

The municipal funds subscribed either by public or private organizations to relieve the distress from unemployment among workers who also contribute to the same fund have not been a success because they have attracted unfavorable risks, the cost has been very high and the solvency of the funds insecure. They have not enlisted the co-operation of the employing group and have afforded relief to only a small proportion of local workmen in seasonal trades.

Public subsidies to workmen's benefit funds have overcome some of these difficulties because they have been based on a more calculable risk and the solvency of the funds has been maintained through the assistance of the public treasury. The weakness of this system is that unorganized workmen have received little or no benefit from it and that the position of the union workers has been correspondingly strengthened. This system has not taken into account the employer as a factor in the unemployment situation, but relied only on such efforts as the labor organization could make to secure employment for their members. These defects led to the introduction of a form of universal compulsory insurance through a state fund.

Compulsory insurance against unemployment exists in Great Britain, Russia, Austria and Italy, and is under consideration in Belgium and Germany. The British system, put into operation in 1912, was the result of careful study of the subsidized voluntary plans and developed out of earlier attempts to meet the problem of unemployment through Poor Law Relief and through labor exchanges. The British system, in con-

trast to continental unemployment insurance systems, was devised primarily to provide relief for regular unemployment instead of abnormal unemployment in emergencies. It was designed to protect organized and unorganized workers alike and so to distribute the risk among as large a group as possible as to make the cost small in relation to potential benefits. It was established on an actuarial basis afforded by trade union employment records and was designed to promote the accumulation of a reserve to tide over bad years.

### Failure of the British Fund

The British Unemployment Insurance Fund became exhausted in 1921 and has involved a large drain on the public treasury since that time, largely because of three circumstances: (1) The acute business depression which caused sudden and long unemployment of large numbers, (2) the inclusion immediately prior to the beginning of the industrial depression of eight million workers not previously insured who drew benefits after making only a few contributions, and (3) the provision for payment to insured workers of special benefits without corresponding contributions, in order to relieve the distress of those who had exhausted their rights to benefits. The system, though possibly financially sound in relation to normal unemployment, proved inadequate under the stress of extreme emergency; it has done practically nothing to stimulate efforts for reduction of unemployment by employers, employees and the state, and the administrative machinery has been found extremely costly. Improvements in the administration of the system, particularly as related to the labor exchanges and the payment of benefits, are under consideration. It is doubtful, however, how much the system could have reduced unemployment because it was adopted after practically every other method of meeting the problem of unemployment had been tried and because unemployment in normal years had probably nearly reached a minimum.

The question of the adoption of a system of public unemployment insurance in the United States involves two specific questions: Is there need for such a system here, and does an adequate basis for the economical application of the insurance principle to unemployment exist in this country?

The studies of the board show that there is in the United States in normal times a considerable body of wage earners without employment, a large proportion of whom may be presumed to be in need of relief. This proportion of wage earners without work is considerably higher in the United States than in the industrial countries of Europe and the available means of relief by voluntary effort are much fewer than abroad. Accurate knowledge of the volume of unemployment and of the extent to which unemployed workers are able to provide for themselves in individual or co-operative ways is, however, lacking here and the extent of the need for systematic relief cannot be fully known until more adequate information exists in regard to unemployment, wage conditions, standards and cost of living, differences in seasonality of industries and savings.

Studies by the board have shown that much can be done by individual employers, and co-ordinated industrial effort to reduce unemployment and some progress in this direction has been made. Although the plans inaugurated in particular establishments cover as yet so small a percentage of the industrial workers of the country as not to have greatly affected the general unemployment contingency, they suggest the possibilities of bringing private initiative to bear on the problems in a variety of ways suited to the special requirements of different groups of workers in industry. They indicate that there exists an increasing sense of industrial responsibility in relation to unemployment and that as technical methods of providing relief and preventive devices are worked out, the cost may be reduced and the worker in time bear some part of it. The private measures so far used to meet the unemployment problem are for the most part relief measures and appear to have been successful as the cost has been reduced through the development of preventive features and the systematization of relief.

The private efforts of employers, trade unions, and other organizations to provide for or prevent unemployment have not as yet, however, developed to an extent sufficient to afford an adequate basis upon which to build a system of public insurance in the United States. The unemployment risk among American wage earners is not known with any degree of definiteness, but available figures indicate that compared with industrial countries in Europe the rate is very high and has not been reduced to a working minimum. The financial basis which would be required for an actuarially safe insurance system in the United States would involve an enormous expense. Furthermore, the political organization of the United States would make the adoption of a national system of unemployment insurance impossible without constitutional changes, and the country's vast extent, diversified industries and social composition would create under such a system an administrative problem of gigantic proportions and cost. If, on the other hand, a system of unemployment insurance were to be built up by the separate states, the complications arising from attempting co-operation between the states in the placement of workers and adjustment of compensation would likewise present administrative problems of difficulty, especially in view of the probability that the legislation in the separate states would differ widely. In addition to these difficulties is the fact that there does not exist in most states either a system of labor exchanges or comprehensive organizations of wage earners, either one of which European experiences indicates as a necessary basis for a public insurance scheme.

### Not Ready for Public Insurance

Such legislation for public unemployment insurance as that projected in the Wisconsin Bill of 1921 and others modelled on it, is based on the recognition of the necessity of promoting individual effort to determine, stabilize and reduce the unemployment risk. On its actual success in achieving this end in practice, depends its cost and effectiveness in the relief of unemployment. This is dependent on better knowledge regarding unemployment and on the extent to which similar methods are adopted in other states and over the country as a whole. Such extensive adoption would require nation-wide legislation which would be of great practical difficulty and great cost. The final question raised by such legislation is whether the stimulation of private co-operative efforts to reduce unemployment which are necessary to meet the need for unemployment relief and serve as a basis for any extended system, can be more economically and effectively achieved by compulsory legislation than by some other means? The problem is, therefore, put squarely to industrial management in the United States to devise such other means.

# Forced and Shrink Fits in Machine Construction and Repair

By W. S. Standiford

The holding of wheels on shafts by means of forced or shrink fits, instead of the usual method of securing the parts by means of keys, does not seem to be used to the extent that it should, considering the excellent results that are obtained with such parts as gear wheels that are subjected to heavy vibration. Pinions held on shafts by keys will not stand jarring for any length of time, and sooner or later they become loose. In case the pressure exerted upon a pinion is continuous, the latter will remain fast upon its shaft for a much longer time than where the motion is intermittent and jerky.

Two keys a quarter-circle from each other will enable a pinion to remain solid longer on its shaft; but the writer has found by experience that, when continuously running machinery is desired, it is much better to force a gear wheel on a shaft by hydraulic pressure, no key being needed. A pinion or gear wheel pressed on in this manner will remain until it requires to be removed because of worn teeth, removal often being quickly effected by cutting a slot in the bottom of a tooth, forcing a wedge in the slot and knocking the wheel off with a hammer. In making pressed or forced fits, the difference in diameter of the members is not great, as all that is needed is to have the grip sufficiently tight to prevent the parts from slipping and coming off. Any heavier pressure puts a strain upon the metal around the hole and may cause a cast-iron pinion to break while in action.

The usual practice among mechanics in fitting work of this kind is to judge the amount of oversize for the internal member by the feel of a caliper; but this is a very uncertain method, as errors are likely to be made in judging sizes. The right way of taking such measurements is by means of an inside micrometer in the hole, and an outside micrometer on the shaft. This puts all measurements upon an exact basis, the worker knowing just what allowance has been given in thousandths of an inch. A mechanic always gains by doing all such work as carefully as possible, as bad habits once formed are hard to break and often lead to spoiled work.

There is a limit to the size of fits that can be forced or pressed. This is due to the fact that as the diameter of the fit increases, more powerful apparatus is required to press the parts together, so that a point is soon reached where it does not pay to keep an expensive and powerful machine for only occasional use. Force fits are generally made on such comparatively small objects as crankpins, car-wheel axles and machine parts.

## Allowances for Fits

In judging the proper allowance for a press fit, several factors have to be taken into consideration; namely, the thickness of metal surrounding the hole, the kind and quality of the material of which the parts are made, the size of the work, and also the smoothness and accuracy of the bore and shaft that are to be fitted together. As a general rule, to make a press fit of the greatest possible strength, there should be a difference in the sizes of the parts to be fitted together of from 0.002 to 0.003 in. for each inch of diameter.

The following rule will serve to give an idea of the pressure needed for making forced fits for different shaft diameters: The required pressure in tons will be the fit allowance in thousandths of an inch, multiplied by the diameter of the shaft in inches and also by the factor of $1\frac{1}{2}$. As an example, suppose that a gear wheel is to be forced on a 4-in. shaft, the allowance being 0.002 in. for each inch of diameter.

$$4 \times 0.002 = 0.008 \text{ in. allowance.}$$

The pressure in tons will be $8 \times 4 \times 1\frac{1}{2} = 48$ tons.

On smaller diameters of shafts where a very strong grip between the parts is desired, the larger allowance of 0.003 in. can be used.

It will be apparent that, if the allowance figures given were adhered to for very large sized shafts, the required pressure would be very great and beyond the capacity of the appliances found in most shops. To show this clearly, we will suppose that a 14-in. crankpin is to be fitted into its disk.

Then, $0.002 \times 14 = 0.028$ in.,

And, $28 \times 14 \times 1\frac{1}{2} = 588$

tons pressure needed to do the work. Very few factories possess the facilities for obtaining such heavy pressure. However, the extra-tight fits are usually unnecessary. In practice, for a shaft of 14-in. size, it will be found that a 0.012 in. total allowance will hold tightly, the tonnage necessary to force the parts together being very much less.

Some mechanics taper the sections to be fitted, thinking that tighter fits will result. This is bad practice, because the tendency of taper-fitted parts to become loose under vibration is always present. On the other hand, a taper fit does not abrade the contacting surfaces to the extent that a parallel fit does. In order to prevent abrasion in work of this kind, it is advisable to lubricate the surfaces with white lead mixed with a little lard oil, or else rub a piece of ordinary soap over the surfaces. It is best to keep the members as smooth as possible, so as to allow for putting new gears on the shaft, should they be needed later.

## Shrink Fits

Shrink fits are employed in cases where the greatest possible binding effects are desired, being used extensively by machinery manufacturers, and also in railway locomotive shops for putting tires on the driving wheels of engines. Repair forces also use shrink fits to hold parts of machines together in emergency, as well as in permanent work.

As in force fits, the allowance for a shrink fit depends to a great extent upon the thickness and amount of metal around the hole, as this has a great influence upon the stresses in the hub at the bore of the wheel. The higher the heat of the outer member, naturally the greater the expansion and the subsequent shrinkage. By properly sizing the parts, it is possible by the shrinkage method to control definitely the amount of pressure between a wheel and its shaft. In actual practice there are limits beyond which it is not safe to go, on account of the mechanical stresses set up when the metal is cold. Should the final pressure exceed the elastic limit of the steel, a permanent set will occur, the metal around the hub being under a strain and likely to develop a crack. Should the pressure on the hub be so great that its ultimate strength is exceeded, it will burst when the parts become cold.

For the general run of machine work, an allowance of about 0.004 in. for each inch of diameter of the fit will give satisfactory results. On account of their large diameters, railroad locomotive tires are shrunk on with an allowance of from $\frac{1}{32}$ to $\frac{1}{16}$ in. per foot, of diameter, and they give effective service in withstanding shocks.

# Scientific Selection of Materials for Forgings

## Selecting Steels to Suit the Job—Specimens Subjected to Exhaustive Tests—Importance of Heat-Treatment—Work Supervised by Laboratory

SPECIAL CORRESPONDENCE

THERE is probably no piece of metal entering into machine construction that is subjected to more severe usage than the crankshaft of the high-speed internal combustion engines of automobiles and aircraft. From the moment the engine is put into service this shaft is called upon to withstand a rapid succession of hammerlike blows to the number of thousands per minute that, aside from the wringing and twisting strains to which it is at the same time subjected, would soon disintegrate any but the most carefully designed and structurally perfect forging.

It is not enough merely to say that such a forging must be sound and of good material. In order to be certain that the crankshaft will render continuous and satisfactory service it is necessary for the manufacturer to know by actual test that the steel from which the forging is made is free from structural defects; that it is sufficiently strong to absorb the shocks and convert them into useful work; and that it possesses the property of resilience to a degree that will enable it to endure the continued hammering of the pistons and their connections and preserve its structure.

FIG. 1—THE STEEL YARD

It thus devolves upon the manufacturer of high-grade crankshaft forgings, who would jealously guard his reputation as a supplier of strictly first-class material, to subject the steels from which his product is made to a most careful scrutiny, not only for visible defects in its structure but in the matter of chemical composition and the more intimate physical properties that can be determined only by the application of tests.

The Wyman-Gordon Co., operates extensive forging plants at Worcester, Mass., and Harvey, Ill., specializing in the production of forgings for automobiles, where there are maintained complete laboratory systems for determining the properties, both chemical and physical, of each lot of steel received from the steel mills, establishing a permanent record thereof and supervising the progress of the stock through the forge and heat-treating departments. This article is based upon a trip through the Worcester works.

The suitability of a steel for a definite forging—as a crankshaft for an automobile engine—is determined by its ability to resist the peculiar shocks and strains to which such a shaft is subjected in service and as this ability follows to some extent the chemical composition of the steel the chemical analysis must necessarily be the basis upon which the stock is selected.

All orders to the steel mills, therefore, specify the chemical content of the required material, and this content is the basis upon which a consignment is accepted or rejected. To meet the specifications the mill prepares a "melt" of steel in accordance therewith. When the melt is rolled into bars each bar is stamped with a number that designates that particular melt and nothing else. This is the "heat number" to which further reference will be made in this article, and it remains the identifying symbol of a given lot of steel up to the time that the consignment is analyzed by the purchaser.

To the layman it would seem that, given a definite chemical content, all steels conforming to that analysis should be reasonably uniform regardless of their origin. But this is far from the case. So many factors enter into the making and rolling of steel that two heats, even from the same mill, though they may be identical in so

FIG. 2—BORING FOR SAMPLES FOR THE CHEMICAL ANALYSIS

far as the chemical laboratory is able to determine, may exhibit widely differing physical properties.

Because of this condition it is necessary to consider each melt, or "heat," of steel individually, determine its characteristics separately, and segregate the forgings made from it in their progress through the shop so that each lot will receive the treatment best calculated to bring out its wear- and shock-resisting properties.

In Fig. 1 may be seen a part of the receiving yard of the plant under discussion, and from this view the reader may discern how each heat of steel is stacked separately in accordance with its number. As the mill heat number signifies nothing apart from the records of the mill that produced it, and as it is quite possible for the same number to designate two or more very different kinds of steel if they come from different mills, the first step in the process of segregation is to assign to each stack in the yard an identifying symbol that must not under any circumstances be duplicated. This symbol is the "analysis number," and in Fig. 1 it may be seen conspicuously painted in several places upon each stack.

In the office of the laboratory there is a file of 5 x 8-in. cards, and as each consignment of steel is laid down in the yard the name of the supplying mill and the mill heat number are entered upon one of the cards, to which is assigned a consecutive analysis number. This number is immediately painted upon the stack in the yard and thus is established a record to which later will be added the actual chemical content of the steel as determined by the laboratory, the results obtained from the physical tests, and finally, the disposition of every bar in the consignment.

To complete the segregation and make certain that not a single bar shall be used for any purpose to which it is not adapted, or receive any treatment other than that indicated by the requirements of its composition, each bar in the stack is stamped with an individual number running consecutively from 1 up to the number of bars in the stack.

Borings are taken, as shown in Fig. 2, from the ends of the bars for the purpose of analysis. The bars are sampled in two places; at the center of the section and at a point midway between the center and the outer surface. These samples are placed in stout envelopes each marked with analysis number, the bar number, and "outside" or "center" according to the boring.

As the purpose of this article is to cover in a general way the system of supervisory control exercised by the laboratory over the selection of material and such operations as affect its properties in subsequent handling, no attempt will be made to describe in detail the actual tests. To give the reader an idea of the complete equipment provided, Figs. 3 and 4 are presented, showing parts of the chemical laboratory.

Though the result of the chemical analysis establishes the status of a consignment of steel it is by no means conclusive as an index to what the steel may be expected to endure in service. Though it may with comparative safety be assumed that, given a uniform showing by several bars in the same heat, all the bars in that heat will display similar characteristics, it does not follow that bars from different heats, though having exactly the same chemical content, will behave in similar manner under the physical tests. Indeed, wide variation may be expected in the latter case.

At the same time that the borings are taken for the chemical analysis, short sections are cut from several bars of each heat, and these "coupons" are forged to a round section of 2½ in. diameter, regardless of the size or shape of the bar from which they are taken. These coupons are then subjected in the laboratory to a tentative heat-treatment based upon the chemical content and in accordance with the judgment of the engineer in charge. After heat-treating, the coupon is sawed apart lengthwise and one of the resulting half-round

FIG. 3—THE BALANCES IN THE CHEMICAL LABORATORY

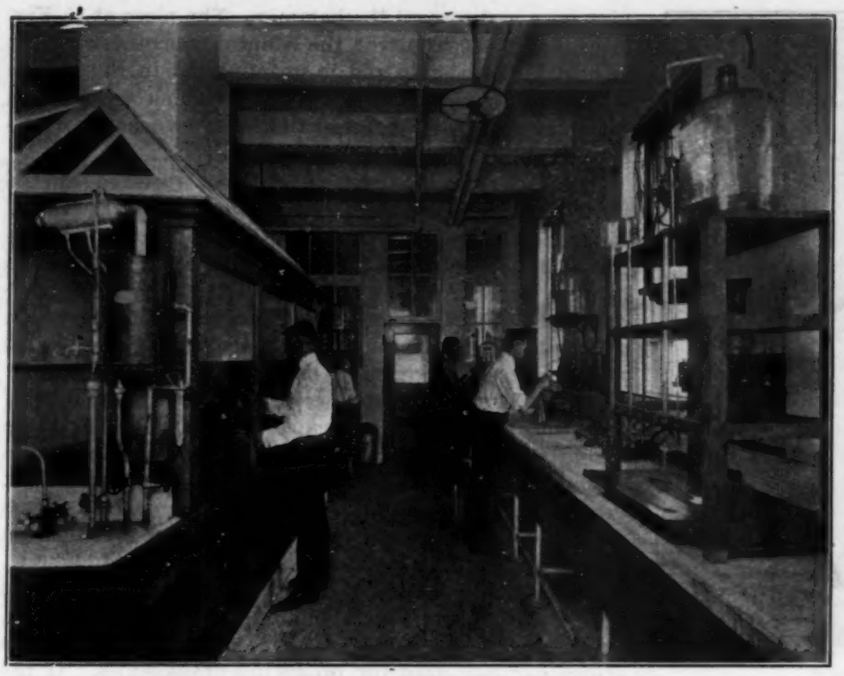


FIG. 4—TESTING AND ANALYZING SPECIMENS

pieces is again split, reducing it to quarter sections.

The half-round piece is preserved and to it are applied Brinell tests for hardness, both upon the outer surface and also upon the surface exposed by the saw.

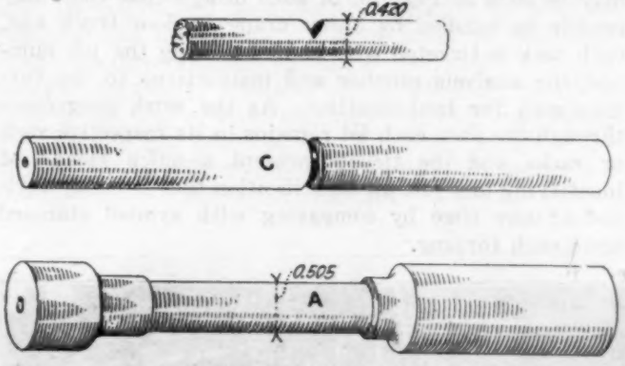



FIG. 5—SAMPLES PREPARED FOR THE PHYSICAL TESTS

In the first heat-treatment of a specimen the only guide is the result obtained upon previous specimens of similar analysis, and is in the nature of an experiment. It is here that discrepancy between qualities indicated by chemical content and those actually exhibited under actual physical test are manifested. Though the same temperatures and methods of handling may have been employed upon this as upon previous samples of like nature, the specimen may prove to be too hard or too soft. If the Brinell test indicates a variation in this respect that puts the sample outside the allowable limits of hardness, the coupon may be retreated or other coupons taken from the same or other bars and subjected to treatment at different temperatures, until the proper treatment has been found to give the sample the requisite physical properties.

From one of the quarter sections of the finally selected coupon a test piece as shown at *A* in Fig. 5 is made up for the tensile test. The small diameter at the center is 0.505 in., giving a cross-sectional area of $\frac{\pi}{10}$ sq.in. This test piece is put in the testing machine shown in Fig. 6, where it is pulled apart and the "yield point," or limit of elasticity and the ultimate strength, are automatically recorded upon the chart of the machine. This test also indicates the ductility of the steel.

The property of resilience which gages the ability of the material to stand up under long continued shocks, is tested in two ways. The machine shown in Fig. 7, called the Stanton alternate impact testing machine, is a device for delivering continuous blows of definite moment upon a specimen that is turned half way over after each successive blow so that the hammer tends to bend it first in one direction and then in the other until it breaks. The weight of the hammer, the distance through which it falls, and the rapidity with which the blows are delivered may be changed to suit the conditions. For this work the hammer weighs ten pounds and falls through a distance of 2 in. 90 times per minute. When the specimen breaks the machine automatically stops and the total number of blows that have been delivered is registered on a counter.

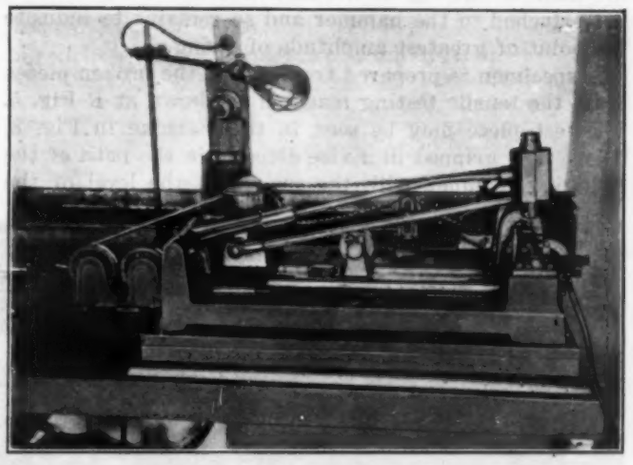


FIG. 7—THE STANTON ALTERNATE IMPACT MACHINE

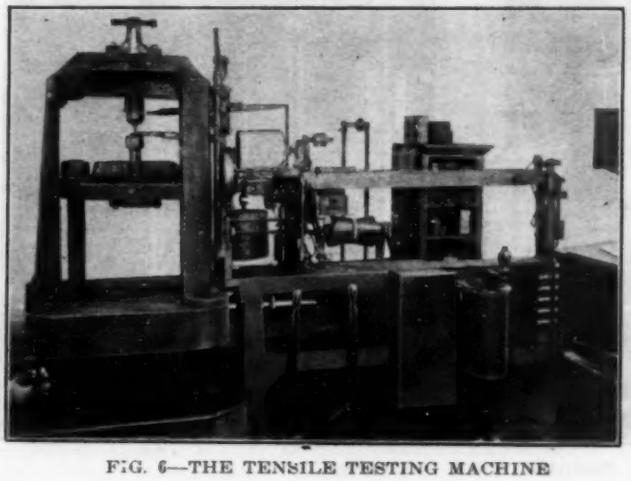


FIG. 6—THE TENSILE TESTING MACHINE

An entirely different method of testing the resistance of the specimen is provided by the Izod impact testing

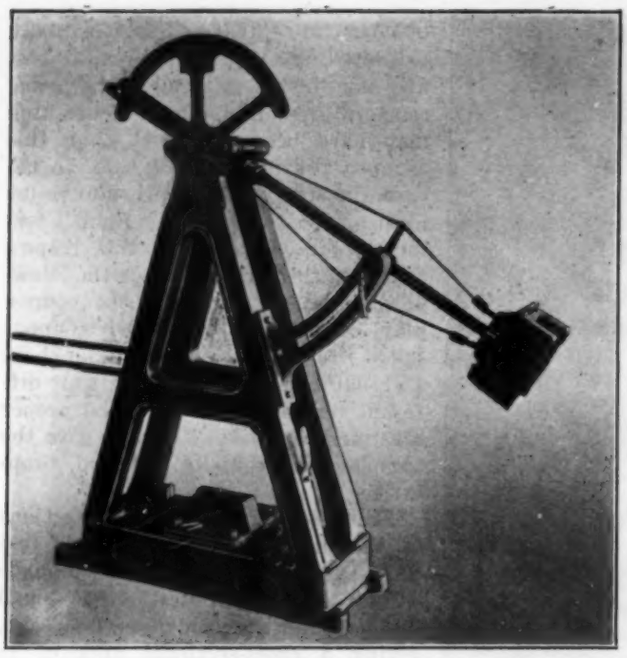


FIG. 8—THE IZOD MACHINE

machine, shown in Fig. 8. This machine breaks the sample the first time the hammer strikes it, but the distance that the hammer swings beyond the point where it contacts with the sample is a resultant of the height of fall and the resistance of the test piece. A movable pointer is pushed by the forward swinging hammer over the scale at the top of the machine, but the pointer is not attached to the hammer and so remains to indicate the point of greatest amplitude of swing.

A specimen is prepared from one of the broken pieces from the tensile testing machine as shown at *B* Fig. 5. The test piece may be seen in the machine in Fig. 8, where it is gripped in a vise directly in the path of the swinging hammer with the groove at the level of the vise jaws and toward the hammer. The piece at *C*, Fig. 5, has been prepared for the Stanton machine where it is held by both ends and is unsupported in the middle where the hammer falls. This specimen is ½ in. in diameter and the square sectioned groove has a diameter at the bottom of 0.40 inch.

Samples from every heat of steel received at the yard are passed through the above outlined series of tests and the results are tabulated upon the cards in the file. The laboratory is therefore in a position to assign to each order for forgings a steel that can be guaranteed to meet the conditions specified upon the order, and to attach instructions for heat-treating the forged pieces in accordance with their requirements.

To further insure the segregation of certain kinds of steel and to make it impossible for even one bar to be subjected to improper heat-treatment, each forging is stamped while at the forging heat with a symbol that denotes the analysis number and thus furnishes a means of identifying single forgings in case they are removed from the regular progression for any purpose.

The manufacture of crankshafts is done so far as is practicable in one heat; including breakdown, forging, trimming, and indexing. In Fig. 9 may be seen a large steam hammer used for producing crankshafts. If the design calls for a flange to be forged upon the shaft an extra heat is necessary at that end of the forging for the operation.

As the bars from the yard are sheared to forging length the pieces are stacked upon racks, one of which may be seen in Fig. 10, of such design that they may readily be handled by either crane or floor truck and, each rack is ticketed with a card bearing the job number, the analysis number and instructions to the furnace men for heat-treating. As the work progresses through the shop each lot remains in its respective rack or racks and the tickets present a quick means of identifying any job, an identification that is easily verified at any time by comparing with symbol stamped upon each forging.

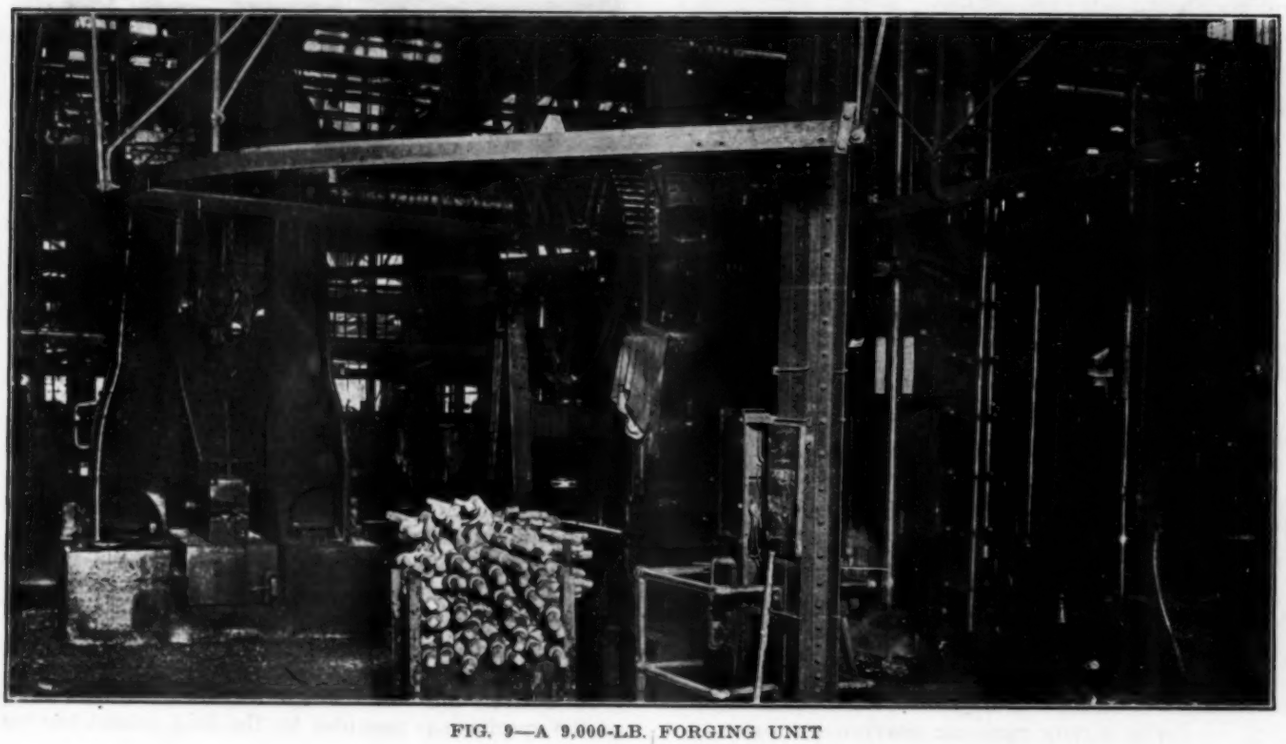


FIG. 9—A 9,000-LB. FORGING UNIT

In making up the forgings a definite proportion of each lot (usually one in six) is left with an extra piece of metal or "coupon" attached, so that tests of the metal may be taken from the forgings at any stage.

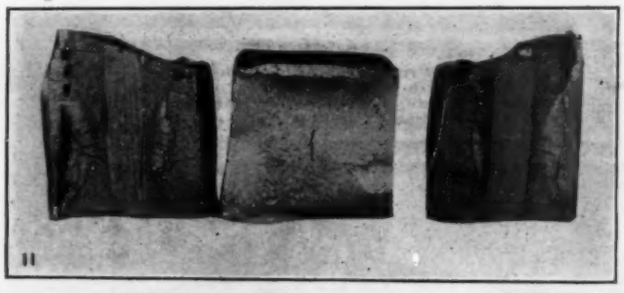
The heat-treatment of the finished forgings is an operation of prime importance and it is here that the knowledge of the properties of the steel gained by the laboratory in its preliminary tests is demonstrated to its full advantage. The index card shows the exact temperatures that must be attained to bring out the qualities of the steel.

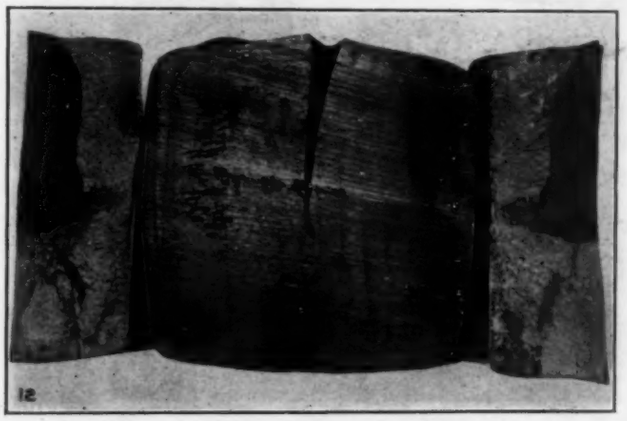
In this department oil fired furnaces are used exclusively. They are each fitted with an electrically operated automatic regulating device that is under control of the pyrometers and may be set in advance to bring the furnace to any desired temperature and hold it within a total variation of not more than 5 degrees.

Various grades of carbon, chrome-nickel, chrome-vanadium, and other alloy steels go into the forgings and each requires its own particular heat-treatment. Hardening heats are fairly uniform; ranging from 1,450 to 1,650 deg. depending upon the grade of the steel to be treated. Draw heats may range from 1,000 to 1,200 deg. Fahrenheit.

From the draw heats the crankshaft forgings go directly to the special straightening presses while hot, where they are straightened to bring the journals and crankpins into alignment and insure sufficient material to "clean up" in the subsequent machining operations.

Besides the tests outlined above a constant watch must be maintained upon the structure of the steel by means of the microscope. Though a lot of steel may show a uniform analysis and the coupon under test may demonstrate that it possesses all the necessary qualifications in the way of strength, ductility, etc., local structural defects may creep in and, if allowed to escape the vigilant eyes of the laboratory inspectors, prove to be a prolific cause of mysterious failures.




FIGS. 11 AND 12—LOCAL STRUCTURAL DEFECTS IN STEEL

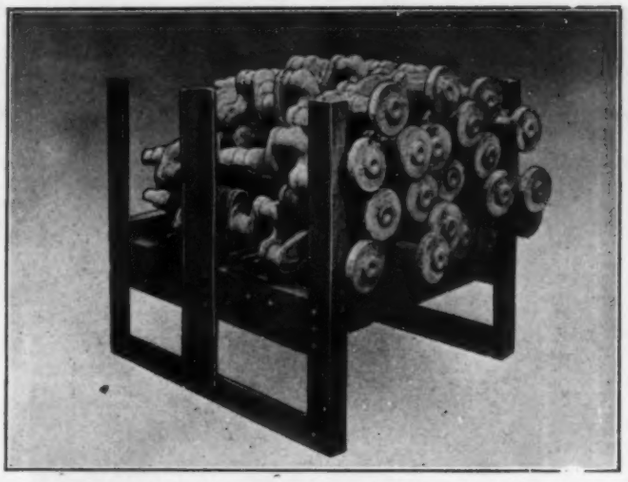


FIG. 10—RACK UPON WHICH THE WORK IS HANDLED IN THE FORGE SHOP

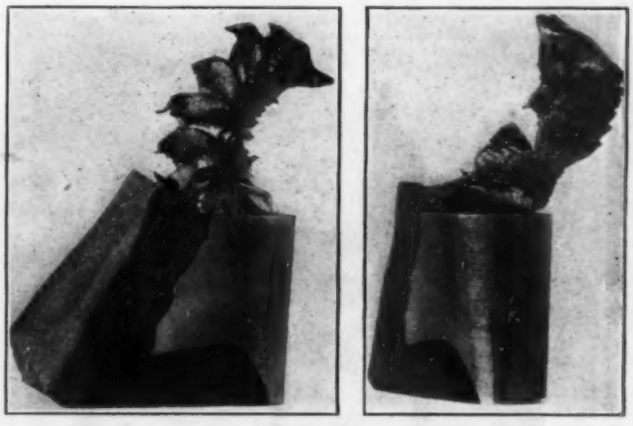
Though no microscope is needed to show the defective structures displayed in Figs. 11 and 12, they may be accepted as evidence of what may be expected in more minute degree in any lot of steel, even though all tests have proved it to be of good quality as a whole.

## An Unusual Break in a Tire Turning Tool

SPECIAL CORRESPONDENCE

The illustrations show a remarkable break in a tool used for turning locomotive driving wheels on a 90-in. wheel-lathe in the plant of William Sellers & Co., Inc., Philadelphia, Pa. The tool section at the break is 3 x 1½ inches. The cutting edge is unimpaired.

At the time of the break the lathe was turning the



BROKEN TOOL WITH CUTTING EDGE STILL SHARP

tires on a pair of drivers 82½ in. in diameter with a cut varying from $\frac{7}{16}$ to $\frac{5}{8}$ in. in depth on each toolrest. The feed was $\frac{3}{8}$ in. per revolution and the cutting speed 14½ ft. per minute, consuming 52 horsepower.

The tools had been reground for this pair of wheels. As there were other interruptions during the turning of this pair of wheels no record was made of the time, but just previous thereto a pair of 80-in. wheels was turned in 42½ minutes; also a pair 56 in. in diameter in 47 minutes; another pair 76 in. in diameter in 44 minutes; a pair 67 in. in diameter in 39 minutes, and a pair 54 in. in diameter in 38 minutes, all times given being from floor to floor.

# SPECIAL AUTOMOTIVE

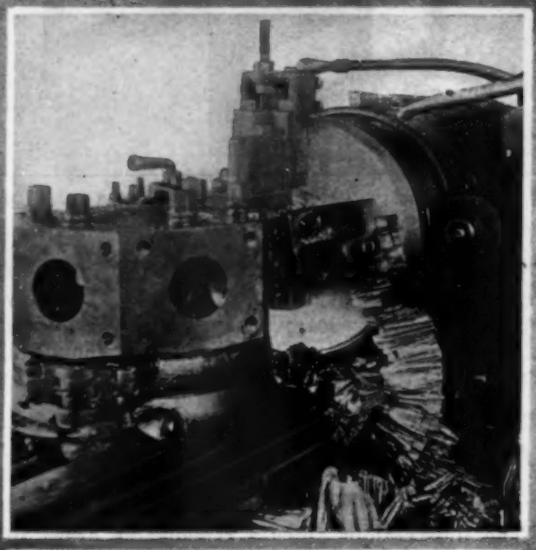
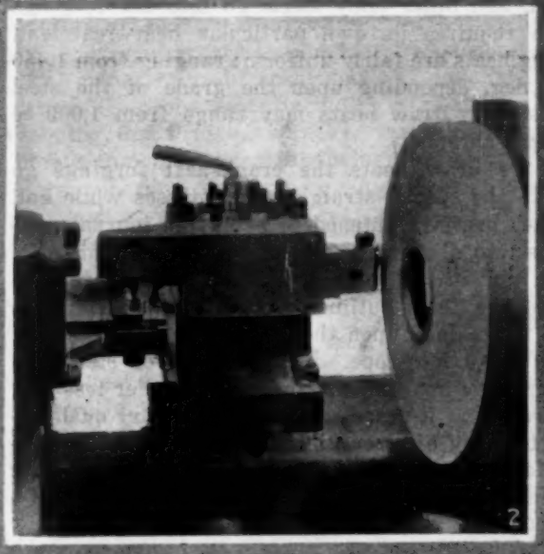


Fig. 1—Libby lathe machining a Duesenberg forged steel brake drum. The tooling is very simple and the work of boring, turning and facing is completed in 12 minutes

Fig. 2—A similar piece of work for the Rolls-Royce, except that the face of the drum is slightly conical. A taper attachment bolted to the turret, guides the toolblock



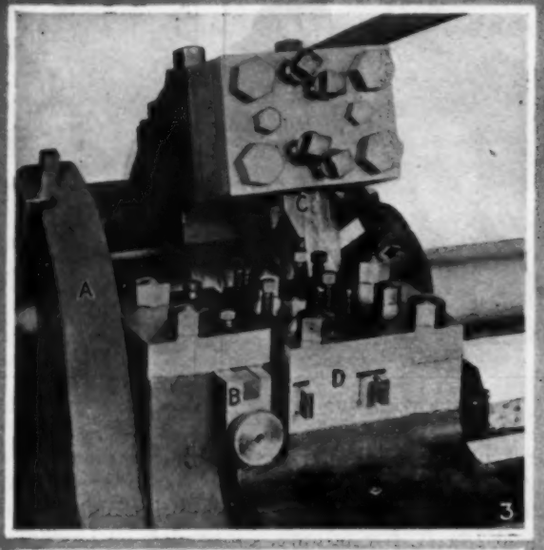
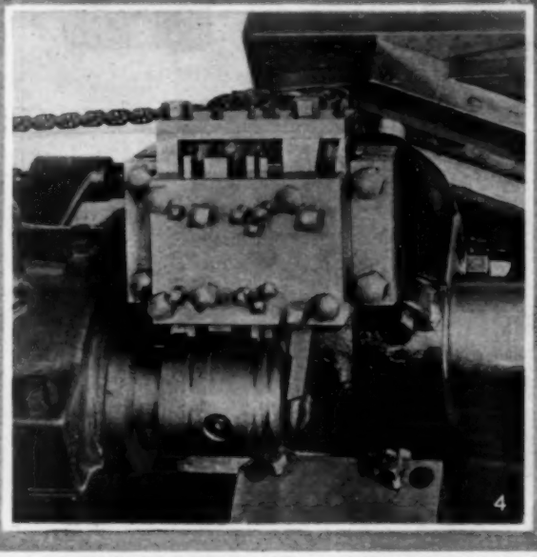



Fig. 3—Reed-Prentice piston lathe. Roughing tools in *A*. Semi-finish tool at *B*. Facing and chamfering at *C*. Grooving at *D*. Time 1 min. 30 seconds

Fig. 4—Reed-Prentice lathe for finishing. Front tools finish three diameters. Back tools finish groove, relieve center, face and chamfer end. Time 2 minutes



# MACHINING METHODS

**Fig. 5—Detroit centerless grinding machine. About 250 ft. of work runs through machine per hour. Average handling rate 1,200 pieces per hour**

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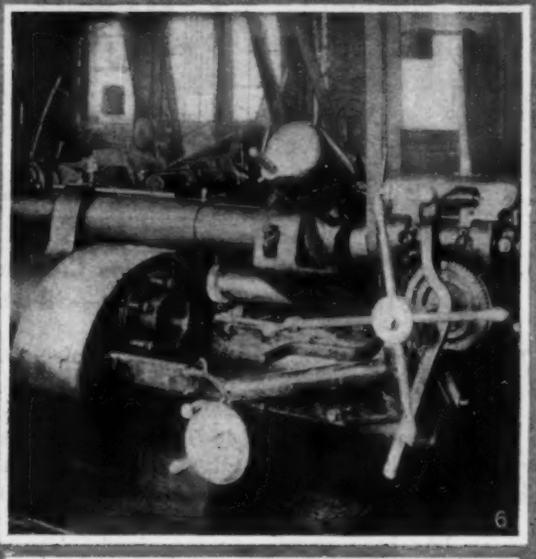
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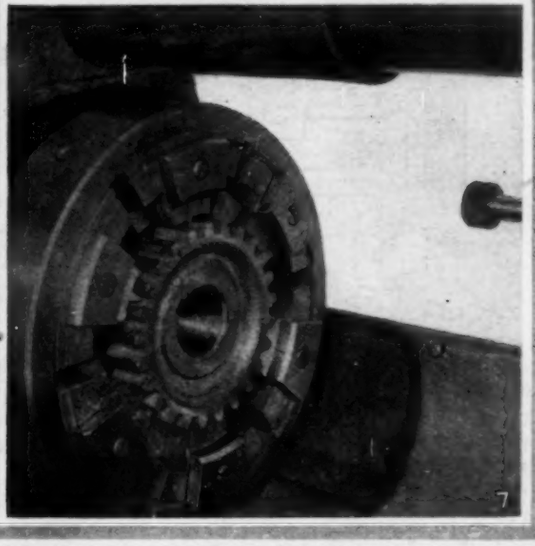
**Fig. 6—Bryant chucking grinding machine on Liberty cylinders, 0.035 in. removed. Tolerance 0.0005 in. Roughing 0.030 in., 6 per hour. Finishing 0.005 in., 5 per hour**

**Fig. 7—Bryant chucking grinding machine. Root control jaws in collet chuck. Hole 1⅜ x 1⅞ in., 0.10 in. removed. Tolerance 0.001 in. Production 65 per hour**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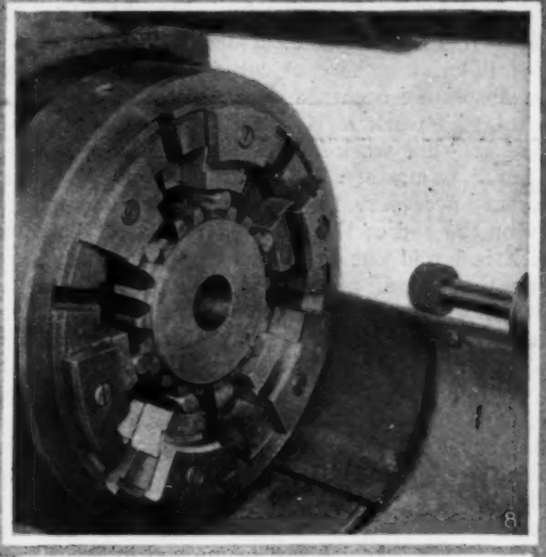
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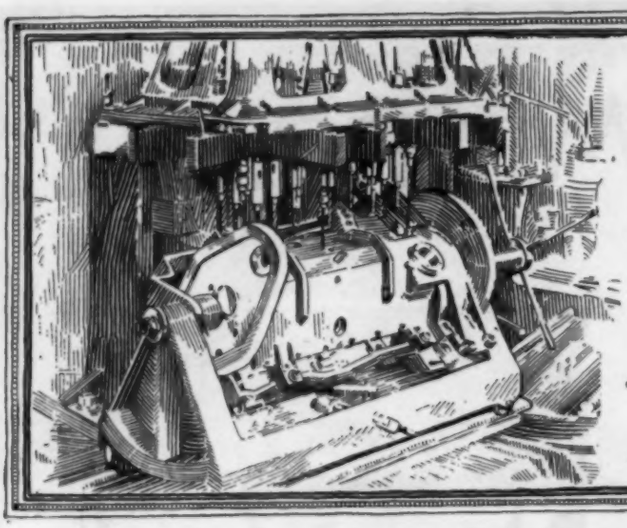
**Fig. 8—Bryant chucking grinding machine. Collet chuck with roller for pitch line control. Stock, finish, tolerance and production same as Fig. 7**



# Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

## Fixtures for Grinding Operations Continued—Methods of Holding for External, Internal, Disk, Surface and Form Grinding—Standard and Special Fixtures and Magnetic Chucks

WHEN work has been previously finished, a collet or fixture of some kind is often found necessary. There are some cases where a chuck can be used such as that shown at *H* in Fig. 411 in the previous article, although for a great deal of work the chuck is not accurate enough to produce first-class results. Fig. 418 shows several methods of holding work which has been previously machined. The example at *A* shows a piece of work *B* held in a collet at *C*. This collet is tapered at *E* so that it fits a corresponding taper in the nosepiece *D*. It is drawn back into position so that it grips the work firmly, by means of a rod which extends back through the spindle as at *F*. In grinding the hole an internal grinding attachment is used, with a wheel as shown at *G*.

For certain kinds of work the method of holding just described will be found satisfactory, although in many cases a collet cannot be considered sufficiently good to produce absolutely accurate work. In the example *H* a piece of thin work *K* is to be ground internally by the wheel *O*. The work locates in a hardened collar *L* which fits it accurately. In order to avoid distortion, the pressure necessary for holding the work is exerted entirely on the end of the piece by means of the clamp *N*, which is bored out to a diameter sufficiently large to allow the grinding wheel spindle to enter. The studs which hold the clamp in place are two in number, and they are inserted in the body of the fixture *M* as shown. For light work the clamp can be set up by means of thumbscrews instead of the nuts. By bringing pressure to bear in this way on the end of the work there is very little danger of distortion, and therefore a piece of work which is thin can be clamped firmly enough to allow the grinding to take place.

In the example shown at *P* the work *Q* is to be ground internally by the wheel *U*. The method of location in this case is by means of the pins *R*, which are set in a hardened ring against which the work is clamped by means of the straps *T*. These straps are operated by thumbscrews as indicated. The fixture *S* is screwed directly to the spindle of the machine. In rare cases this method of holding may be found satisfactory, but it will seldom be so unless great accuracy has been maintained in the previous operations, and unless the locations for these operations have been made from the same holes. There are instances when a piece of work must be ground on the inside after the outside has been finished; and when a subsequent grinding operation for the outside surface is necessary, the hole can be ground first and the work placed on an arbor for the second grinding operation with the assurance that a concentric job will result.

The example at *V* shows a piece of work *W* which has been previously machined on the angular surface

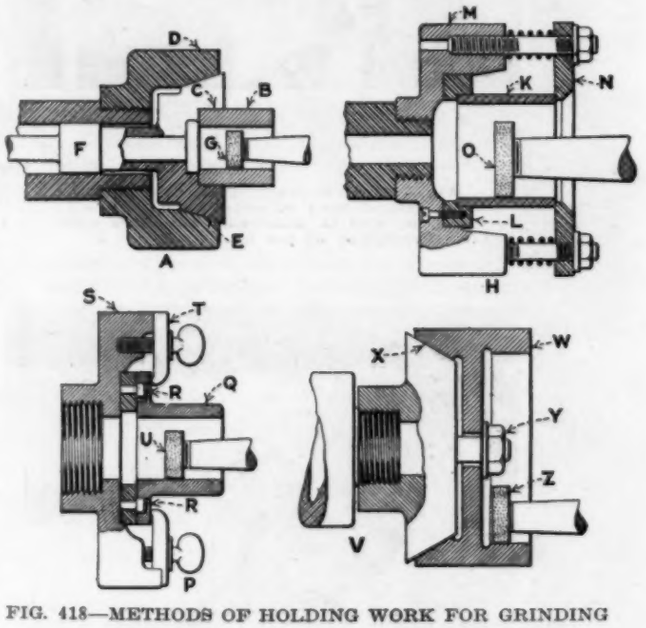



FIG. 418—METHODS OF HOLDING WORK FOR GRINDING

*X*, and it is necessary to grind the other side concentric with the angular portion. The work is located on a taper plug at *X* and is clamped by means of the nut and washer at *Y*. The grinding is done by an internal grinding attachment, using the wheel *Z*. This is a very simple fixture and the only points of importance in connection with it are the clearance for the grinding wheel spindle and wheel and the method of clamping. This particular case permits a center clamp,

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but other instances may be found where such a means may not be possible, in which case a special method may be found necessary.

In order that a spur gear may run true after it has been hardened, it is usually considered necessary to grind the center hole. Many times the process of hardening distorts the gear to some extent, so that the teeth do not run perfectly true with the hole. A portion of a spur gear is shown at *A* in Fig. 419. The outside diameter *B*, the pitch diameter *C* and the thickness of the tooth *D* are subject to a certain amount of change during hardening. In order to locate the hole so that it will be central with the pitch line of the gear, pins are placed between the teeth as shown at *F*. The distance *E* from the center of the gear must be determined and maintained with care. The diameter of the pin should be such that the pin will strike the tooth directly on the pitch line, and as this point lies on a curved surface care must be taken to see that the pin is correctly proportioned.

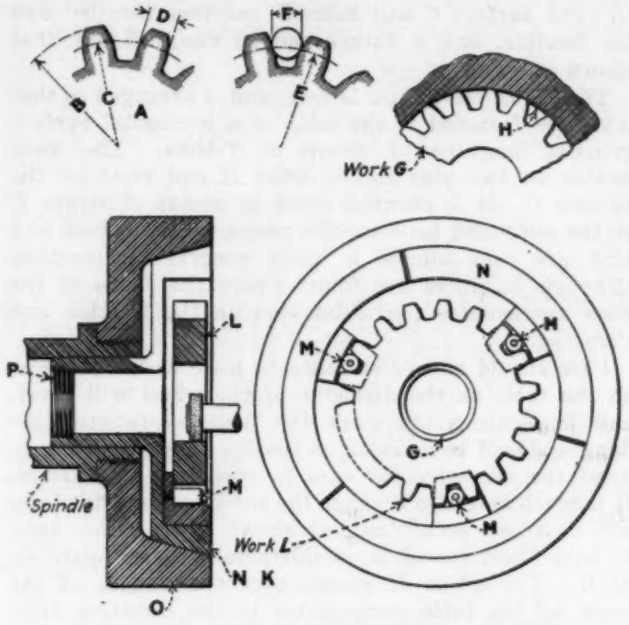



FIG. 419—LOCATING SPUR GEARS FOR GRINDING

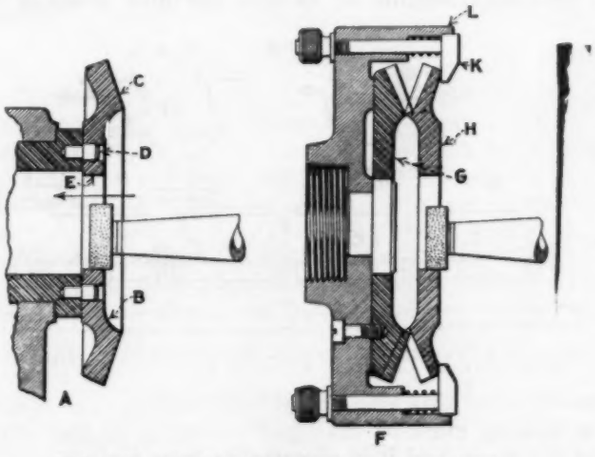



FIG. 420—LOCATING BEVEL RING GEARS

In the example *G* the method of locating is by means of the outside diameter of the gear in a pocket *H*. This method is not usually considered good, as it may be found that the distortion will not allow the gear to locate properly so that the hole will be central.

The diagram at *K* shows the construction of a collet chuck for holding spur gears. The gear *L* locates on three rollers *M*, which are set in the collet *N* so that they will move inward or outward as the collet is contracted or expanded. The rollers may be three, four, five or six in number, depending on the number of teeth in the gear. They must be so placed that they will come in contact between the teeth and on the pitch line. The collet used is mounted in a nosepiece *O* which screws to the end of the spindle. The operation of the collet is by means of a closer which screws in to the end *P*. Various applications of this principle can be used for any work of a similar kind, and it is only necessary to design the holding device so that the contraction of the collet will cause the rollers to move inward in a truly radial direction.

In Fig. 420 is shown at *A* a bevel ring gear *B* in which the hole *E* must be ground so that the face *C* will run true with the pitch line of the gear. In this case the work is located on three pins *D* and clamped against the hardened ring by means of springs which are applied to the angular face *C*. This method may be considered good, providing the locating surface has been previously ground from the pitch line of the gear, but otherwise there is likely to be trouble due to the warping of the angular surface during hardening.

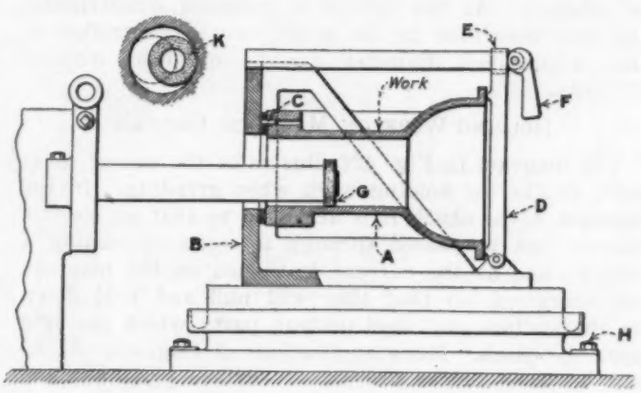



FIG. 421—HORIZONTAL CYLINDER GRINDING

A better way of grinding the hole is shown in the example at *F*. Here a master gear *G* which is accurately made is screwed to the face of the fixture and located centrally. On this master the ring gear *H* is located, being clamped in place by means of the hook bolts at *K*. This gives the pitch-line location, so that when the hole is ground it will be true with the pitch line of the gear. The hook bolts *K* are of light construction and in some cases springs can be used, although the latter must be very stiff unless the gear is of small size. The hook bolts can be operated by thumbnuts at the rear of the fixture *L*.

Cylinders for gas engines are often finished by grinding, and the machine used for the purpose has a spindle arranged horizontally and carried in eccentric sleeves, as shown at *K* in Fig. 421. Provision is made so that the eccentricity of the spindle can be adjusted, to take care of various diameters within the capacity of the machine. The type of fixture required for work of this kind is quite different from any which has been previously shown. Sometimes the work is ground wet and sometimes dry, and provision may be made for the removal of the dust by a vacuum system. Usually the

work *A* is held on an angle-plate fixture *B* and clamped against a surface perpendicular to the spindle of the machine. Very often the location is obtained by means of several pins, as shown at *C*, and the cylinder is clamped by some convenient method.

In the example a latch *D* is arranged so that it can be thrown down out of the way when not in use, and when in the position *E* a cam lever *F* locks it in place and at the same time forces the cylinder against the locating surface. The nature of the clamp used is dependent entirely upon the size and shape of the cylinder casting which is to be ground. In operation the

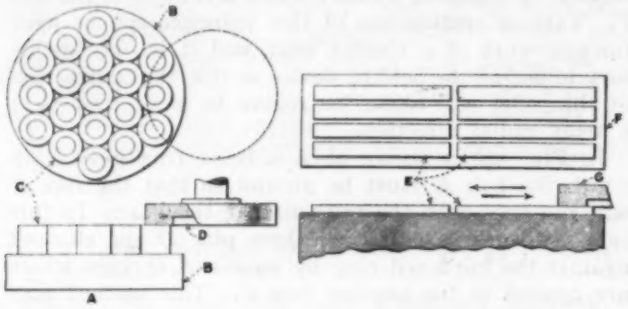



FIG. 422—HOLDING WORK ON MAGNETIC CHUCKS

wheel *G* is mounted on the end of a long spindle, and the table *H* is fed gradually along while the wheel is in rotation. As the spindle is mounted eccentrically, the path described by the wheel can be controlled so that a specified diameter can be obtained without difficulty.

### Holding Work on Magnetic Chucks

The diagram in Fig. 422 illustrates the use of magnetic chucks for holding work when grinding. In the example *A* the chuck *B* is arranged so that an electric current can be passed through its coils by closing a switch; and as the current is turned on the magnets are energized, so that they will pull and hold down on the surface any steel or iron parts which are laid upon the chuck. Many applications of magnetic chucks can be made to the process of surface grinding, and in the example indicated a number of bushings *C* are grouped together on the chuck so that the ends can be ground by means of the cup wheel *D*. The chuck *B* revolves and is fed forward under the wheel when in operation.

Another type of magnetic chuck is more in the nature of a table, since it is rectangular in shape as at *F*. This type is also used for surface grinding, but the table reciprocates in the direction indicated by the arrows, so that the work passes back and forth under the wheel *G*. In grinding a group of flat bars such as those shown at *E*, the bars can be laid down on the magnetic table and held there by magnetism.

In extreme cases thrust pins can be suitably placed so that there is no danger of the work shifting while the operation is going on. This is not generally necessary, except in cases where a very small amount of surface of the work is in contact with the table. Magnetic chucks and tables are used extensively in grinding operations, and occasionally a combination of the chucks with some method of locating work can be made. For example, if a location is needed so that work will be ground for only a certain portion of its width or length, suitable stops can be provided.

It is not always possible to hold work by means of a magnetic chuck, and yet a surface grinding operation may be required. A type of fixture used for work of this kind is shown in Fig. 423. The castings *A* are to be ground on the surfaces *B*, and they have been previously machined on the surfaces *C* and in the holes *D*. The surface *C* and holes *D* can therefore be used for location, and a fixture can be designed like that shown at *E*.

The bed of the fixture is long, and is arranged so that it can be fastened to the table of a horizontal surface grinding machine by means of T-bolts. The work locates on two pins in the holes *D* and rests on the surface *C*. It is clamped down by means of straps *E* at the ends and between the pieces. Fixtures of this kind are very simple in their general construction, although instances are found where the shape of the piece necessitates particular care in the location and clamping.

Care should always be taken to place as many pieces on the table as the diameter of the wheel will cover, and in locating the work the distance between the flanges should be as small as possible, always having in mind the necessity for ease in operating the clamps. It is much better to arrange the work so that the pieces will approach each other, as shown at *F*, rather than to have them spaced a considerable distance apart, as at *G*. The wheel *H* passes over the flanges of the work as the table reciprocates in the direction indicated by the arrows.

### Disk Grinding

The fixtures used for disk grinding are generally very simple in their design, as the work which is done is a plain surfacing operation. Fig. 424 shows a piece of work *A* in contact with a revolving disk *B* on which there is an abrasive substance. The surface which is to be ground is shown at *C*. The piece is held in a fixture *D*, located against pins *E* and clamped by some convenient method which can be rapidly operated. The table *F* is arranged so that it can be forced in against the work by means of a lever *G*, and at the same time it is pivoted on a shaft *H* so that it can be swung on this shaft as a bearing. A counterweight *K* balances the entire unit so that it is not topheavy.

The requirements of fixtures for disk grinding on

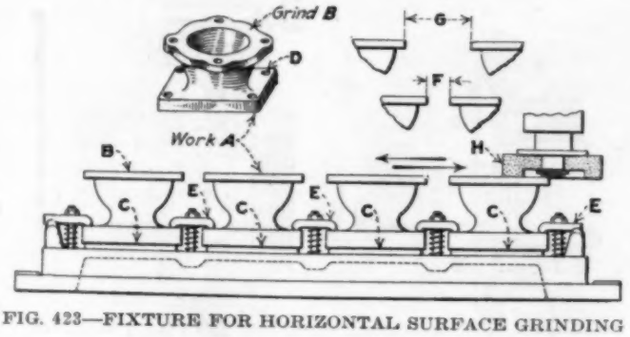



FIG. 423—FIXTURE FOR HORIZONTAL SURFACE GRINDING

machines of this kind are of the simplest. The method of holding must be developed according to the nature of the work, and it is essential to have a quick method of clamping. Aside from this the design of fixtures is along the same lines as those used for milling. The amount of metal removed, however, is comparatively small so that the pressure on the work is not as great as when milling.

The example mentioned is applied to a disk grinding

machine having a single wheel; but it is often desirable to surface two sides of a given piece of work at the same time, and when this is the case the double-disk type of grinding machine is to be preferred. The diagram at *L* illustrates the action of the disks on a piece of work *M* which passes between the two disks *N* and *O*

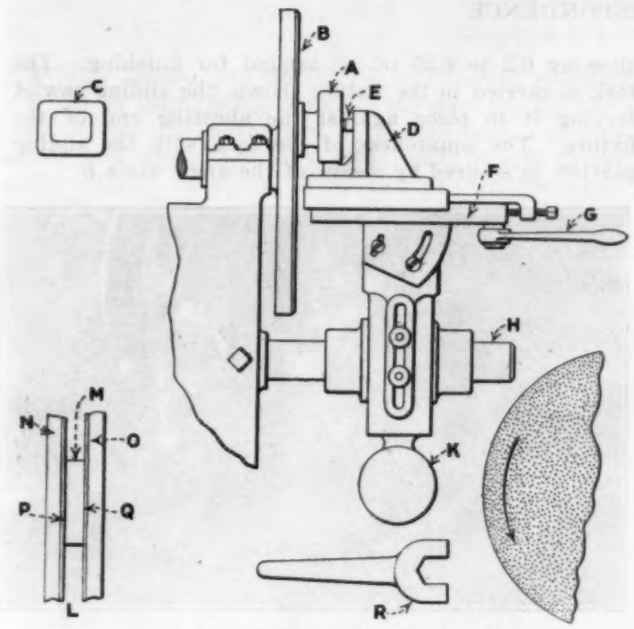



FIG. 424—EXAMPLES OF DISK GRINDING

so that an abrasive action takes place on both sides at *P* and *Q*. The work is usually held on a slide so arranged that it can be passed between the two disks by means of a lever or handwheel.

Any fixtures used for work of this kind must be arranged so that the clamps will not extend beyond the edge of the fixture, as otherwise they would interfere with the action of the disks. For work such as the wrench shown at *R* on which the two sides are to be surfaced, a double-disk grinding machine has many possibilities. There are no other points in connection with the design of fixtures for this kind of work which need comment.

### Form Grinding

In the grinding of forms of various kinds two methods are in common use. In one of these the wheel is "dressed" to the shape of the form required, while in the other the wheel is controlled in its movements by means of a form of suitable shape so that the desired contour is generated. Fig. 425 shows an example at *A* in which the work *B* is ground on the diameter *C*, the face *D* and the fillet *E* at the same time by means of a wheel which is shaped to the form shown.

Another example of a piece of work which can be handled by means of a formed wheel is shown at *F*. Here the wheel is formed to the angle *G*, and the portion *H* made straight so that both the angle and cylindrical portion are ground at the same time. In the form shown at *K* the work is of a curved contour, and therefore the wheel must be very carefully formed to the shape shown at *L* in order that the surface may be ground accurately and to the required dimension. These examples all illustrate the field which is covered by the process of grinding with a formed wheel. A cylindrical grinding machine is used for this work.

For the generating of surfaces either internal or external another type of machine is required, but two methods are possible on some of this work. For example, the piece shown at *M* is to be ground on the taper at *N* and in the straight hole *O*. This work can be done by means of an internal grinding machine arranged so that the taper will be generated by the taper slide. After this has been done the slide can be set over to grind the straight portion *O*.

By using a type of machine which has a control or form plate, both surfaces can be ground in the same setting without any change in the position of the wheel or of the slide. Briefly stated, machines of this kind have a spindle which carries a grinding wheel and a follower which controls the position of the spindle. The form plate is made in accordance with the shape which is to be generated, and the follower rides on this plate, thus causing the wheel to produce the shape desired. A plate for the work shown at *M* would have a taper portion to correspond with that at *N* and a straight portion like that at *O*.

Another example, shown at *P*, has a curved portion *Q* running into a straight hole *R*. This work would be done in the same manner as that previously described, and the only difference would be in the shape of the form plate. In the example *S* the work has an internal curved surface running into a straight hole. The form of control plate used for this operation is

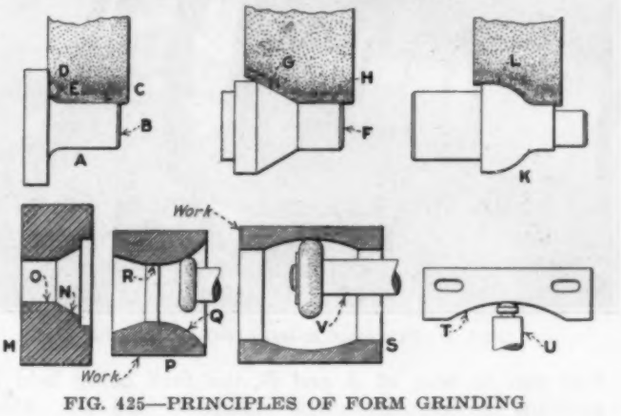



FIG. 425—PRINCIPLES OF FORM GRINDING

indicated at *T*, the follower pin *U* controlling the movement of the spindle *V* to produce the desired contour.

To make sure that the hole is properly shaped, considerable attention must be given to the shape of the follower, in order that the generation may be correct as determined by the movement of the follower pin and the wheel. The proper shape of the grinding wheel periphery must be carefully laid out, and the plate formed in such a way that it will cause the wheel to travel in exactly the direction desired.

## The Application of Principles

By Robert Grimshaw

After the principles of management and execution have been laid down distinctly and in considerable detail by "the powers that be," it is the foreman's work to see that they are applied in their entirety wherever he exerts authority and bears responsibility. Naturally, various interpretations of general principles may present themselves to different foremen; but, as a rule, the variations are more in the way in which the principles are applied than interpreted.

# Machining the Pierce-Arrow Gear Shifter Fork

## Special Fixtures and Milling Cutters—Four Milling Operations Cover Most of the Machining—Casehardening, Annealing and Sand Blasting—Final Operations

SPECIAL CORRESPONDENCE

AFTER rough-grinding and straightening the forgings, the fork is straddle-milled by the pair of cutters shown in Fig. 1. The fork is held in substantial jaws which are almost hidden by the milling cutters themselves. The cutters have forged inserted teeth held in position by suitable clamps and headless screws. The kind of chips removed by the cutters can be seen under the cutter arbor. An allowance of 0.008 in. on each side, is made for further finishing.

The fork is carburized, after which the circle or radius is milled as shown in Fig. 2. The ends of the

FIG. 1. STRADDLE-MILLING THE FORK

fork can be seen at *A* and *B*, the fork being held in position by the substantial clamps *C* and *D*. After removing the burrs, the top and bottom, as well as the shoulder of the bolt lug are milled, as shown in Fig. 3,

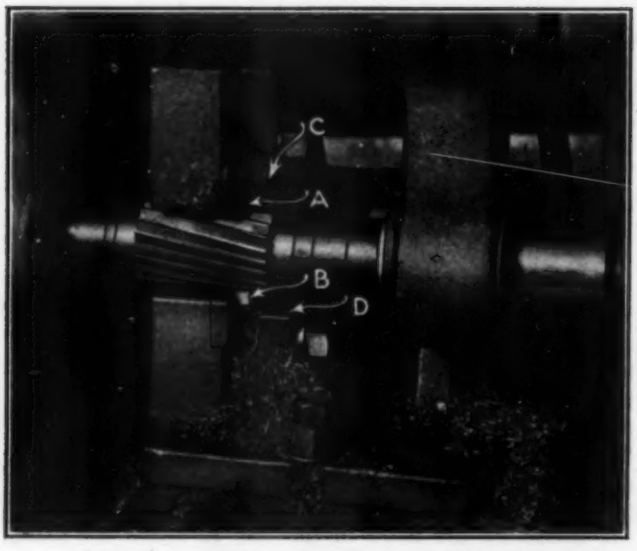



FIG. 2. MILLING INSIDE OF CIRCLE

allowing 0.2 to 0.25 in. all around for finishing. The fork is carried in the fixture shown, the sliding jaw *A* forcing it to place against the abutting end of the fixture. The squareness of the fork with the sliding portion, is secured by means of the angle plate *B*.

FIG. 3. MILLING THE BOLT LUG

Next the ends are milled to length, the fork end cut off and after removing any burrs, the fork end is casehardened and the other end annealed. Sand blasting follows these operations, after which a scleroscope test is made on both the hardened and annealed portions of the fork.

The fork is then straightened and opened if necessary, and the large diameter ground. This is followed by another milling operation, as shown in Fig. 4, by

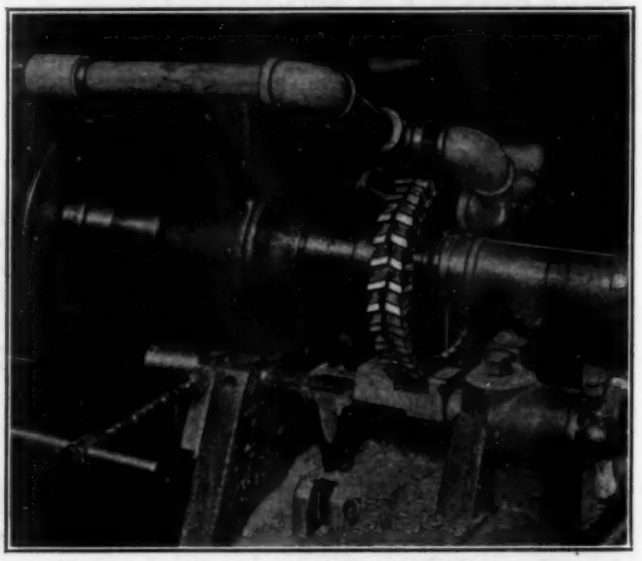


FIG. 4. FINISH-MILLING BOTTOM AND SHOULDER

which the bottom and shoulder are finish-milled. Drilling, reaming, burring and countersinking the screw holes, together with grinding out the small diameter on the fork end completes the operations as carried out in the Pierce-Arrow plant in Buffalo, N. Y.

# Methods of Machine Tool Design

## Fourth Part of Section on Gear Drives—Good and Bad Points of Cone and Tumbler Device—Requirements for Successful Operation

By A. L. De LEEUW
Consulting Editor, *American Machinist*

THE oldest, and therefore best-known, so-called quick gear change device is the cone and tumbler. It has the advantage of compactness and simplicity and lends itself to a great many speeds in one shift without additional complications. On the other hand, it requires great care in the design when applied to anything but light loads. Fig. 92 shows it in its simplest form. The gears *A-B-C-D-E-F* are keyed to the driving shaft. Pinion *H* slides on the driving shaft and transmits power to any of the cone gears through idler *G*. Of course this action may be reversed and the cone made the driving member, while the sliding pinion is driven. *G* and *H* are held in the bracket *J* which also slides on the shaft. A handle, attached to *J*, serves to slide *J* along the shaft, and also to swing it so as to bring idler *G* into mesh with one of the cone gears.

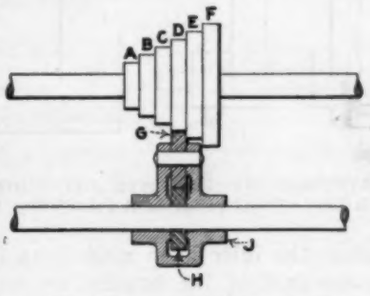



FIG. 92—SKETCH OF CONE AND TUMBLER

Some of the difficulties one meets when applying the cone and tumbler arrangement are very evident even from this crude sketch. The failings of the system were at first not recognized or perhaps overlooked, and the arrangement was applied wherever a quick change device was required. As a result it began to show up its limitations and undesirable qualities and gradually came to be considered by many designers as unfit for anything. It is well to recognize limitations in a device, but this should only serve to limit its application to cases where it properly belongs, and not to condemn and drop it entirely.

In order to make this arrangement a success, it should be so constructed that it can stand the load without danger of breaking or too much deflection and without any features which permit it to vibrate. In addition, it should be possible to operate it with ease. It is, of course, easy to proportion the gears properly for the load, but there are difficulties to face when it comes to the shaft. If, for instance, each of the six gears, *A-B-C-D-E-F*, were of 1½-in. face, their total length on the shaft would be about 9½ in. The length of the pinion shaft between bearings would then be 9½ in. plus the length of bracket *J* on the shaft.

### Length of Bracket Bearings

It is sometimes thought that the shaft finds bearings in bracket *J*, but this is not the case. The shaft does not support the bracket, but is supported *by* it. It might be thought that, this being the case, the bearings in bracket *J* can be made very short, but again this is not the case; for the bracket carries the load of the tooth pressure, so that the pressure between bracket and shaft is equal to this tooth pressure. The length of the bracket on the shaft must therefore be the same as the length of the stationary bearings for this shaft. This causes the length of the shaft between its bearings to be excessive in many cases. In addition to the tooth pressure, the shaft must support the weight of bracket and idler. This condition of having heavy pressure on a shaft of which the bearings are spread far apart makes a very undesirable arrangement and should be avoided when possible.

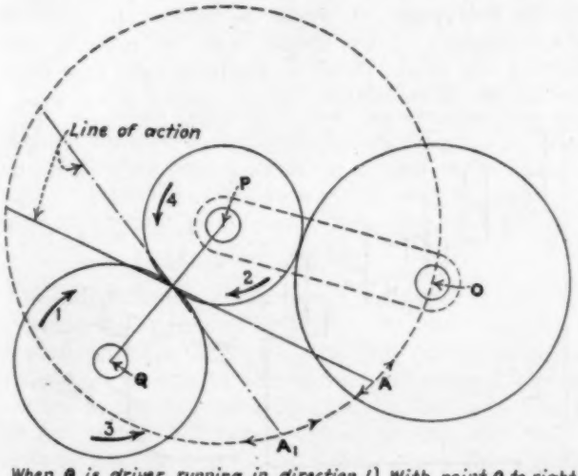



FIG. 93

When Q is driver running in direction 1 } With point O to right of A gear P is pulled into mesh
or " P " " " " " 2 } " " " O " left " A " P " pushed out of mesh
" Q " " " " " 3 } " " " O " right " A " P " pulled into mesh
" P " " " " " 4 } " " " O " left " A " P " pushed out of mesh

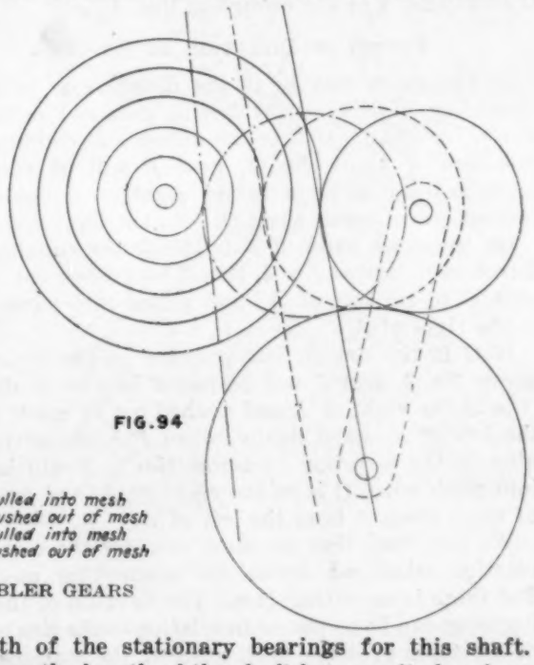


FIG. 94

FIGS. 93 AND 94—DIAGRAMS TO SHOW ACTION OF CONE AND TUMBLER GEARS

For the author's forthcoming book. All rights reserved.

It is often thought necessary to embody a wide range of speeds in the cone and tumbler arrangement, so that, if we wish to keep the largest of the gears within reasonable limits, we must make the smallest of these gears as small as it is possible to make it, and this means that the driving pinion also should be kept to the smallest possible diameter. Consequently, it is often not possible to give the shaft the desired rigidity by giving it a large diameter. It will therefore be necessary to find a construction to avoid the long unsupported shaft.

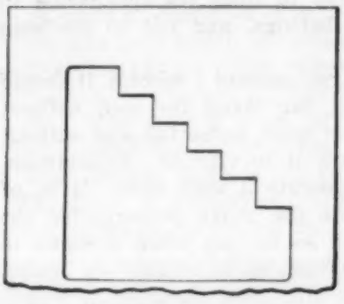


FIG. 95

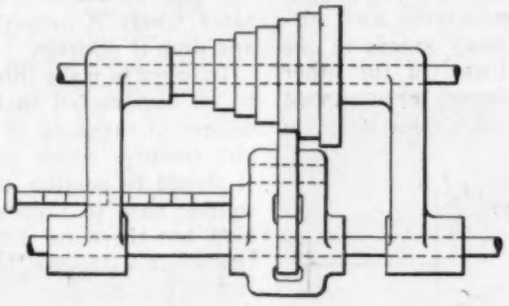


FIG. 96

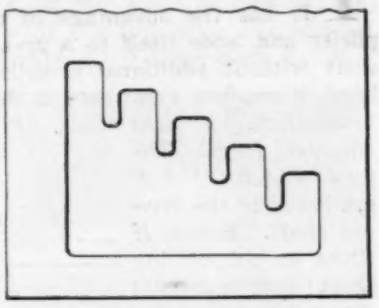


FIG. 97

FIG. 95—LEVER OPENING IN GEAR BOX. FIG. 96—AN ATTEMPT TO SEPARATE SHIFTING AND SWINGING FUNCTIONS. FIG. 97—NOTCHED CASTING FOR LOCATING TUMBLER SHIFTING LEVER

The original construction of this device had a single lever by which the bracket was moved endwise as well as swung into mesh. Whether this construction is maintained or whether two separate devices are supplied, one for the sidewise motion and one for the swinging movement, this latter motion presents a problem of its own. Fig. 93 shows a pair of gears in mesh, one of the gears being held on a swinging arm which permits it to be brought into or out of mesh. The line of action between gears $P$ and $Q$ may be either the full line $A$ or the compound line $A_1$.

### Effect of Direction of Rotation

The pressure may be in one direction or in another, depending on which is the driving gear and on the direction of rotation. If $Q$ is the driver and running in the direction of arrow No. 1, gear $P$ will be pulled into mesh so long as $O$ is to the right of $A$, but will be pushed out of mesh when $O$ is to the left of $A$.

On the other hand, if $P$ is the driver running in the direction of arrow No. 4, it will be pushed out of mesh with $O$ to the left of $A_1$, and pulled into mesh with $O$ to the right of $A_1$.

If $Q$ is the driver, but running in the direction of arrow No. 3, gear $P$ will be pulled into mesh also when $O$ is to the right of A and pushed out of mesh when to the left of $A$. And finally, when $P$ is the driver, running in the direction of arrow No. 2, it will be pulled into mesh when $O$ is to the right of $A$, and pushed out of mesh when it is to the left of $A$.

We see, then, that we must consider the direction of rotation when we devise our controlling mechanism. But there is more than this. The fulcrum of the swinging lever can be so placed in relation to the line of action of the tooth pressure that, whether the stationary gear turns in one direction or another, it will always throw the swinging gear out of mesh. Whether this will happen or not depends on the relative positions of the centers of the two gears, the fulcrum of the lever, and the angle of action.

In Fig. 94 the smallest and the largest of a set of cone gears are shown and it will be seen that an entirely different set of conditions is met according to whether the idler meshes with the small or with the large gear. It may very well be possible that the small gear has a tendency to pull the idler into mesh, whereas the large gear may have the tendency to throw it out. This matter was discussed to bring out the fact that it is necessary to lay out carefully the conditions of centers, and the line of pressure for both the largest and the smallest gear.

As a rule, bracket and lever are so constructed that when the idler is in mesh with one of the cone gears, some part of the bracket or maybe some part of the lever rests against a solid abutment. As the bracket is swung from the outside toward the center of the cone, and as the cone gear has a tendency to pull the idler gear in, a solid stop under the bracket will fill our conditions. It might be asked whether it would be possible to arrange the parts so that the cone of gears has a tendency to throw the idler out of mesh. The answer is, that this is very well possible but that it would be very undesirable.

In the first place, it would be difficult to mesh the gears, especially if we should want to make a shift while the load is on. Even a relatively light load might make the shift impossible. In the second place, even if

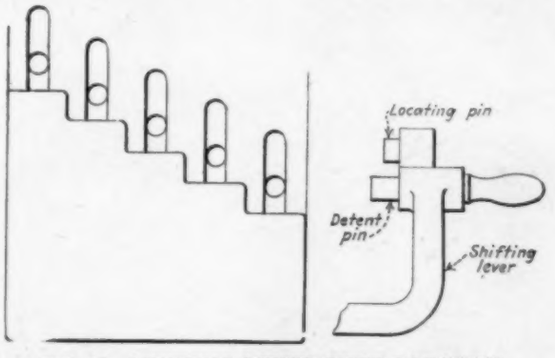



FIG. 98—SHIFTING LEVER WITH LOCATING AND DETENT PINS

the shift had been accomplished, there would be a constant tendency to throw the idler out again; and if we should furnish an abutment so as to prevent this throwing out, we would have to place it above the bracket and it would have to be swung out of the way when we desired to make a new shift. In other words, the abutment could not be solid and it would require additional handling.

This fact makes the cone and tumbler arrangement rather unfit where we have a reversal in the direction of movement, and where this reversal mechanism is

located between the source of driving power and the cone and tumbler arrangement. Though we might have made the shift while everything was running in the proper direction, as soon as the reversal had been accomplished the idler would be thrown out of mesh and away from the supporting abutment.

There is another reason why the length of the bracket on the shaft should be considerable, and that is that the shifting lever must be of fair length in order to have enough power to swing the idler into or out of mesh when the gears are under load. This long leverage would cause the bracket to cock on the shaft and prevent the sidewise shifting.

The problem of shifting is a complicated one in practice, though it looks quite simple at a first glance. Fig.

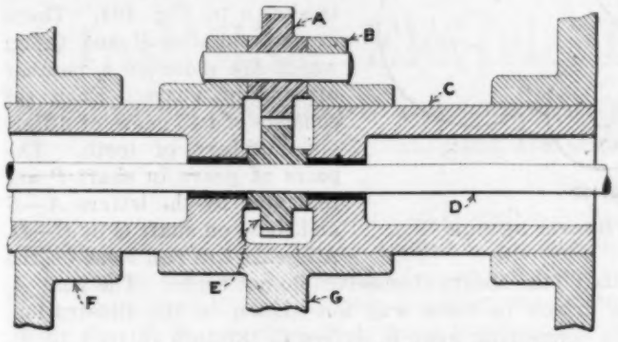



FIG. 99—ARRANGEMENT OF TUMBLER FOR LIGHT MILLING MACHINE

95 represents the opening in the gear box through which the lever projects. The steps shown form the abutments for the lever when the gears are in mesh. In order to change speeds the lever is first brought down as far as the lower edge of the opening permits, after which it is shifted sideways so as to bring the idler opposite the proper gear of the cone. It is quite clear that there is nothing to indicate when this is the case, because the lever is some distance away from its abutment. A mark on the lower edge might indicate the proper position, but this is lost as soon as the lever is swung upward to bring the gears into mesh. There is a chance then that we butt up against the next larger gear. Altogether it requires some skill to accomplish the shift without fumbling.

### Separating the Functions

For this reason a great many constructions have been developed and patented in which the two functions of sidewise shifting and swinging into mesh have been separated. In one of the earlier attempts a rod was attached to the bracket somewhat as shown in Fig. 96. The rod projects through a slot in the side wall of the feed box; it is provided with a knob for handling and has V-shaped rings turned in, the proper distances apart. The device was crude, but it indicates that the need was felt for a better shifting arrangement.

In other devices a circular rack was turned on the hub of the bracket and a pinion provided for the sidewise shifting, while this entire arrangement was put in a swinging housing of which the trunnion projected through the side wall so that the gear could be swung into mesh by a lever attached to this trunnion. There were, then, two levers, each one provided with a detent pin. The proper number of holes was provided for each pin, so that it was only necessary to make sure that the two pins were located in corresponding holes.

Less complicated arrangements sought to guide a single lever by means of slots in the casting, somewhat like Fig. 97. This scheme works fairly well when the gears are of wide face, but if this is not the case, the projecting narrow strip of the casting becomes too weak and liable to be broken off. In still other arrangements, the lever was provided with a detent pin and another short pin was placed a little distance ahead of the detent, so that it could be located in a slot provided for that purpose before the gears began to mesh (see Fig. 98).

Most of these schemes had some merit, but none overcame the chief objection of the cone and tumbler device, namely that it was supported by a long shaft and that it was merely located and not locked.

### Shifter for Light Milling Machines

In Fig. 99 is shown an arrangement patented by the writer and applied by the Cincinnati Milling Machine Co. to the feed box of its lighter millers. It overcomes entirely the first objection, while a solution of the second one was not attempted. In this device *A* is the idler which turns with its shaft in bracket *B*. This bracket is fastened to a finished cylindrical casting, C. This casting is bored out and bushed so as to provide bearings for the driving shaft *D*, and immediately adjoining driving pinion *E*. The cylinder *C* is trunnioned in the frame of the feed box *F*. The shifting lever *G* is bolted to the cylinder. The front wall of the feed box has an opening large enough to allow the shifting lever the necessary play.

It will be seen that the driving shaft is not subject

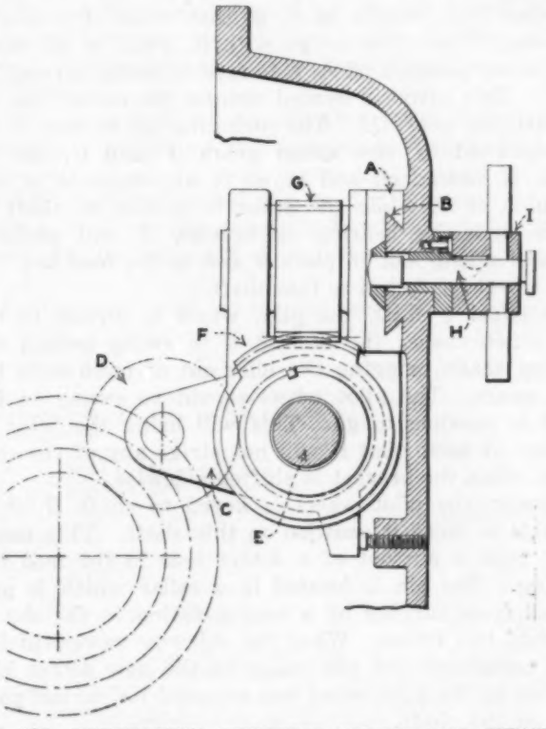



FIG. 100—SUCCESSFUL SHIFTING DEVICE FOR HEAVY-DUTY MILLING MACHINE

to deflection, due to the tooth pressure, and that the shaft does not have to support the weight of the tumbler. The bearings are close to the driving pinion, as they should be, and furthermore, the cylinder itself closes the feed box completely and makes it dustproof. The great length of the cylinder makes sidewise shift-

ing easy and prevents all possibility of binding. However, the load is still carried by the detent pin and the abutment in the wall of the feed box. Neither is there a proper way of locating the shifting lever before it comes into position.

In Fig. 100 is shown another device patented by the writer and applied by the Cincinnati Milling Machine Co. to the drives and feed boxes of the high power millers. In this device also the shaft is relieved of undue strains, but, besides, the tumbler is powerfully clamped in its proper position, while there are means for positively locating the shifting device before the idler is swung into mesh. In this construction the tumbler bracket *A* is hung on a tobin bronze plate *B* along which it can slide. The bracket *C* which holds the idler *D* is pivoted in *A*, so that, when *A* is moved sidewise, *C* and *D* must go with it, while at all times and in any position of *A*, *C* is free to swing around its pivot. This pivot is located around the center line of the driving shaft *E*. The swinging of bracket *C* is accomplished by two spiral gears, *F* and *G*, one of which is located on and keyed to an extension of the trunnion of *C*, while the other is located on shaft *H* which finds its bearing in bracket *A* and projects through a long slot in plate *B* and in the feed box. A pilot wheel *I* is keyed to this shaft.

To effect a shift, the pilot wheel is turned to the left which causes the bracket *C* to swing around the driving shaft, bringing the idler out of mesh with the cone gears. The pilot wheel should be swung as far as it is possible to go. This will bring the idler so far out of mesh that it will not strike any of the cone gears, when the bracket is shifted sidewise.

Though the pilot wheel is keyed to shaft *H*, it is possible to move it endwise on this shaft. This movement pulls a pin out of a detent hole in the feed box casting. The pin is located in a collar which is prevented from turning by a tongue fitting in the slot of the feed box frame. When the sidewise movement has been completed, the pin snaps in the new detent hole as soon as the pilot wheel has resumed its normal position on the shaft.

Turning the pilot wheel to the right lowers the tumbler bracket and brings the gear into mesh, and a hardened plug in a tail of the bracket against an abutment screw. Continuing the rotation of the pilot wheel brings the tumbler bracket trunnions hard up against their bearings, and the sliding member against its bearing on the plate *B*. The angle of the spiral gear teeth is less than the friction angle, so that the parts remain locked after the pressure is taken off the pilot wheel. This device meets all requirements of the cone and tumbler arrangement, but is rather expensive and should be used only for important drives which have to stand heavy loads.

Many variations of the cone and tumbler construction have been attempted. Many of them were ill-considered freaks, or arrangements which might be tolerated in crude machinery, but which were not applicable to machine tools. However, some of them had some interesting features which make them worthy of a closer acquaintance.

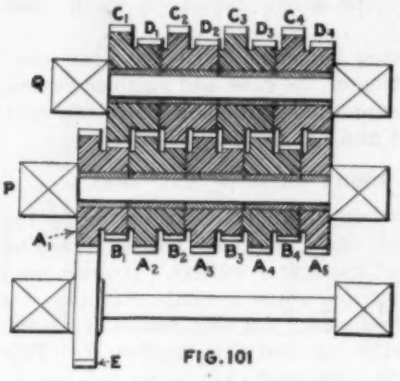


FIG. 101

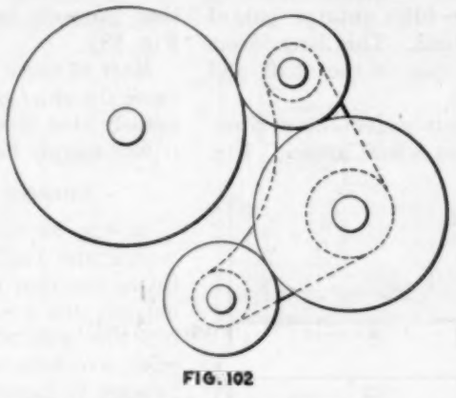


FIG. 102

FIGS. 101 AND 102—VARIATIONS OF THE CONE AND TUMBLER DEVICE

One of these constructions is shown in Fig. 101. There are two shafts, *P* and *Q*, on which are mounted a number of sets of gears. Each set consists of two gears of different numbers of teeth. The pairs of gears in shaft *P* are indicated by the letters *A*—*B* and those on shaft *Q* by *C*—*D*. All gears are run loose on the shaft (the shafts themselves do not turn). The gear $A_1$ is driven in some way not shown in the illustration. Its connecting gear $B_1$ drives $C_1$ through $D_1$ back to $A_2$. The connecting gear $B_2$ through $C_2$—$D_2$ drives $A_3$, etc. It will be seen, then, that we have a series of gears, $A$—$A_1$—$A_2$, all running at different speeds, all on the same shaft, and all of the same diameter, so that a sliding pinion *E* can move from one to the other and thus be made to run at as many different speeds as there are sets of gears in the system. It will further be noticed that the ratio of speeds between two adjoining gears is always the same. This arrangement is very simple in principle and allows for a very simple way of changing speeds by merely sliding the driven gear, but has the disadvantage of requiring a great number of gears, all of which are running all of the time. Besides, a great length on the shaft is required.

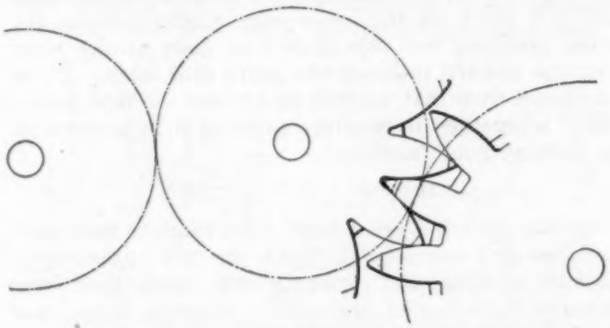


FIG. 103—LENGTHENING GEAR TEETH TO FACILITATE MESHING

There were arrangements such as are shown in Fig. 102, in which the driven gear could be connected to the cone by means of two idlers, one above and one below the cone. These idlers might be of different size, so that for each step of the cone there would be two speeds of the driven gear. Or, again, instead of one of the idlers, a pair of compound gears might be used, thus making a greater ratio between the two sets of speeds obtained. Or, instead of a single idler, there

might be two idlers in one branch of the tumbler, so that right- or left-hand rotation would be obtained, according to which side of the tumbler was in action. All these arrangements have the disadvantage that the tumbler is drawn into mesh on one side and pushed out of mesh on the other side by the action of the gears themselves. Such arrangements do not permit of a heavy construction, and can only be used for light loads.

To facilitate the throwing into mesh of the tumbler gear while under load, various means have been employed. The most common way is to provide the tumbler with a long lever so as to give the operator sufficient power to overcome whatever resistance he may meet. Another way is to continue the curve of the teeth of the idler, in other words, to make the idler teeth pointed. The cone gear may also be made pointed. This facilitates the meshing of the gears, but on the other hand weakens them considerably and this method should, therefore, not be employed for heavy loads. (See Fig. 103.)

Summing up the requirements of cone and tumbler arrangements: The length of pinion shaft should be held to a minimum between bearings; the tumbler should not be supported by the shaft, but should have its individual support; for heavy drives the tumbler should be positively locked; some arrangement should be provided to guide the operating lever before the gears are in mesh.

# Installing Electric Trucks in an Old Plant

## Investigation Necessary to Determine Adaptability—Checking Cost of the Present System —Outfit for Changing Batteries—Ability to Stand General Abuse

By D. WRIGHT

Manager of Production, Dodge Manufacturing Co., Mishawaka, Ind.

THE plant in which it was decided to use electrical trucks consists of good-sized machine, floor and bench work foundries; machine shop and erection floors for the larger class of work; a large section devoted to wooden articles; a sheet metal shop, sawmill and several departments devoted to the smaller lines of both stock and made-to-order machine work. All of these departments, together with such accessory departments as power, tool, inspection and warehouses, are spread in a more or less regular order over a space of several acres.

The products consist of a very large variety of parts, both metal and wood, ranging in weight from an ounce or so to several tons. A large amount of the output consists of items, whose sales values justify their classification as stock, but there is also a considerable output of those pieces, where infrequent demand or uniqueness of design make it necessary to classify as made-to-order goods.

TABLE I. SUMMARY OF ROUTINE DAILY MOVES

| Move | One-man Time, Minutes | Average Daily Trips Single | Average Daily Trips Double | Total Daily Time | Total Daily Cost |
|---|---|---|---|---|---|
| Casting stores to department 1.. | 25 | 0 | 10.5 | 262 | 1.31 |
| Casting stores to department 2.. | 35 | 16.6 | 5.3 | 600 | 3.00 |
| Casting stores to department 3.. | 45 | 2.2 | 9.4 | 489 | 2.44 |
| Casting stores to department 4.. | 30 | 27 | 7 | 616 | 3.08 |
| Department 1 to warehouse..... | 50 | 0 | 43 | 2,150 | 10.80 |
| Department 2 to warehouse..... | 40 | 0 | 22 | 880 | 4.03 |
| Department 3 to warehouse..... | 46 | 0 | 6.5 | 300 | 1.50 |
| Department 4 to warehouse..... | 40 | 0 | 11 | 440 | 1.83 |
| Total daily cost..... | | | | | 27.99 |

The above are merely the common routine jobs, in addition to which there are a large number of regular moves, which are made at longer intervals, together with special jobs of transfer, switching of cars, etc., which are not taken into consideration at this time.

It was this varying nature of output handled, together with the nature of roads to be traveled, that had made it seem uneconomical to consider other than the hand-propelled balanced truck for the moving of material. In fact surveys that had been made by various representatives of electric truck concerns, indicated that it was not feasible to operate either elevating or platform electric trucks over all our runways, and it was this limitation that made it seem inadvisable to consider such an installation.

However, this question was one that persisted in coming up about every so often in spite of its being generally considered as "dead." Anyway, it finally got so persistent that the writer undertook a more complete survey of actual conditions than had yet been attempted, including routes regularly traveled, average trips per day over each of these routes under normal production conditions, average number of men necessary per trip on hand trucks, average time per trip; in fact as detailed a record as possible of all factors entering into our shop transportation system at that time. A summary of the results of these tests appears in Table I.

This investigation proved that there was a large amount of soldiering and unnecesary time lost on each trip over all of the routes, and that, pending the installation of mechanical handling, it was easy to place a time limit on the routes and by means of a rough check on the trips, cut down a lot on actual trucking time.

In the meantime correspondence had been carried on with a number of makers of industrial electric vehicles and a pretty good idea had been obtained as to what the operating cost of various types of electric trucks would be, including depreciation, upkeep, current, operator, interest on investment, etc. The results of this canvass, as summarized in a composite form, are shown in Table II.

TABLE II. COST OF ELECTRIC TRUCK INSTALLATION

(All figures are hypothetical as conditions are changing in market continually and therefore the following can be only illustrative.)

| | |
|---|---|
| Initial expense: | |
| Truck | $2,000.00 |
| Skids, trailers, etc. | 200.00 |
| Charging equipment | 400.00 |
| Total | $2,600.00 |
| Annual expense: | |
| Depreciation on 5-year basis | $520.00 |
| Interest at 7% | 182.00 |
| Allowance for upkeep | 100.00 |
| Total annual charge | $802.00 |
| Daily operating expense: | |
| Daily charge on 300-day basis | $2.67 |
| Daily cost operator 9 hr. at 50c | 4.50 |
| Current cost | 0.50 |
| Total daily cost | $7.67 |

The writer had previously used electric trucks of

several makes in other plants, and from his experience with these outfits, had a pretty well-defined preference for one make, of which he had bought seventeen machines in times past. Accordingly it is easy to see that, when inquiries were sent out, there was an obvious advantage in favor of this particular maker. With the stage set in this fashion, it is noteworthy that the selling efforts of the maker of this particular truck developed into a perfunctory series of letters, containing vague and tardy replies to requests for information and a final complete "petering out" of all intercourses.

Contrasted with this was the attention to detail, generous service and pleasing personal intercourse accorded by the salesman of another concern, who although presenting his own products in as attractive a light as possible, took hold of the whole affair in a constructive way and treated it first as an electric truck installation and then as an opportunity for his particular truck to make good.

We had considerable trouble with our charging outfit, owing to the fact that our factory uses direct current of a high voltage, operating only at certain hours during the day, while the charging voltage on batteries is low and should be continuous over a period ordinarily counted as idle shop time. This charging installation was made after investigation and upon recommendation by the truck makers.

After being led to believe that after buying our truck and the beautifully fitted up charging panel, which came along with it, all we'd have to do was to plug in our charging plug at the end of the day and go home, secure in the thought that the little sentinel on the panel board would attend to such minor matters as reducing voltage, cutting off, starting up, etc., it was a poser to come back in the morning and find that instead of being all charged up and in fine shape to run, our battery had lost whatever charge it might have had, and a day of hand trucking confronted us. This was especially true when the generator had been allowed to "die on the line" before the required charge had been put into the battery.

Ultimately a small motor-generator set actuated by standard city current, which is available at all hours, was installed. This equipment handled the charging very nicely, although mechanically it was of poor design. One functional detail that has not been cared for as yet, has to do with the possibility of a momentary stoppage of the current supply and the ability of the charging outfit to bridge this gap and resume operations as current becomes available.

As our product is made up of a big variety of work and there are a lot of things done with our truck, which are not covered in any estimate or figured in on any cost, it was deemed advisable to compile a weekly report. Fig. 1, from a record kept by the truck driver, in which he makes note of all his moves throughout the day.

Hydrometer readings are taken morning, noon and night, together with a record of the current consumption for the day up to that hour as shown by the ampere meter mounted on the truck.

This close supervision has had the effect of keeping the equipment in first-class shape and especially as it relates to that mysterious, usually-neglected-because-very-little-understood heart of all electric factory vehicles, the storage battery. Our original estimate figured on replacing our battery at the end of between two and three years, but as matters now seem to be progressing, based upon our daily observations, this limit is going to be materially extended.

While on the subject of storage batteries, there is one point in connection with our particular problem which had a lot to do with the delay in making our installation, owing to the unwillingness of some of the truck makers to guarantee the performance of their product under the condition as it existed in our plant.

Our heaviest routine loads are in the form of finished material moving from the various metal-working departments to our small parts inspection. This department is located on the second floor of our warehouse and shipping building and is reached by a steam-hydraulic elevator from the entrance to the first floor. The first floor is several feet above ground level, with the result that all trucks entering this floor must negotiate a ramp with a grade of about 14 deg. and perhaps 40 ft. long.

This ramp is so located as to be practically impos-

ELECTRIC TRUCK REPORT-WEEK ____ TO ____ 192!

| | TRIP | MAT'L | M | T | W | T | F | S | TOT. | AV. | TRIP | MAT'L | M | T | W | T | F | S | TOT. | AV. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 8 | E | | | | | | | | | 6 C | E | | | | | | | | |
| | 1 W | Pulley | | | | | | | | | 6 R | E | | | | | | | | |
| | | | | | | | | | | | 6 W | L | | | | | | | | |
| ○ | 2 2 | L | | | | | | | | | | | | | | | | | | |
| | 2 8 | E | | | | | | | | | | | | | | | | | | |
| DEPTS. | 2 F | Scrap | | | | | | | | | 8 1 | Bolts | | | | | | | | |
| 1-Wood pulley | 2 R | E | | | | | | | | | 8 2 | " | | | | | | | | |
| 2-Iron pulley | 2 W | Pulley | | | | | | | | | 8 W | " | | | | | | | | |
| 3-Mach. shop | 2 W | L | | | | | | | | | | | | | | | | | | |
| 4-Shaft | 2 Y | Scrap | | | | | | | | | | | | | | | | | | |
| 5-Bg. | | | | | | | | | | | 9 5 | Babb | | | | | | | | |
| 6-Clutch | | | | | | | | | | | 9 5 | E | | | | | | | | |
| 7-Steel | 3 2 | L | | | | | | | | | | | | | | | | | | |
| 8-Bolt | 3 3 | L | | | | | | | | | | | | | | | | | | |
| 9-Babbmaking | 3 5 | L | | | | | | | | | C 1 | L | | | | | | | | |
| C-Checker | 3 6 | L | | | | | | | | | C 3 | L | | | | | | | | |
| R-Ruff castings | 3 F | Borings | | | | | | | | | C 6 | L | | | | | | | | |
| F-Foundry | 3 W | L | | | | | | | | | | | | | | | | | | |
| Y-Yard | 3 Y | Car | | | | | | | | | | | | | | | | | | |
| W-Warehouse | | | | | | | | | | | R 2 | L | | | | | | | | |
| | | | | | | | | | | | R 5 | L | | | | | | | | |
| ○ | 5 5 | L | | | | | | | | | R 6 | L | | | | | | | | |
| | 5 6 | L | | | | | | | | | | | | | | | | | | |
| | 5 9 | Dross | | | | | | | | | | | | | | | | | | |
| | 5 9 | E | | | | | | | | | W 1 | E | | | | | | | | |
| | 5 W | Bgs. | | | | | | | | | W 2 | E | | | | | | | | |
| | 5 W | 1st Large 2nd Small | | | | | | | | | W 2 | Pulley | | | | | | | | |
| | | | | | | | | | | | W 3 | " | | | | | | | | |
| | 5 W | L | | | | | | | | | W 3 | E | | | | | | | | |
| | 5 W | E | | | | | | | | | W 5 | E | | | | | | | | |
| | | | | | | | | | | | W 8 | E | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | 6 3 | L | | | | | | | | | | | | | | | | | | |
| | 6 3 | E | | | | | | | | | F 3 | E | | | | | | | | |
| | 6 5 | E | | | | | | | | | Y 3 | Car | | | | | | | | |

| TRIP RECORD-OPERATORS DAILY BOOK | | | | | | GRAVITY & AMP. HRS. OUT OF BATTERY | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TRUCKS PER TRIP | 1 T. | 2 T. | 3 T. | 4 T. | TOTAL | MORNING | | NOON | | NIGHT | | REMARKS |
| | | | | | | G | A-H | G | A-H | G | A-H | |
| M | | | | | | | | | | | | |
| T | | | | | | | | | | | | |
| W | | | | | | | | | | | | |
| T | | | | | | | | | | | | |
| F | | | | | | | | | | | | |
| S | | | | | | | | | | | | |
| TOTAL | | | | | | | | | | | | |
| TRIPS | | | | | | | | | | | | |
| TRUCKS | | | | | | | | | | | | |

FIG. 1. REPORT OF TRUCK OPERATOR

sible of change as to either location or grade and here it was that the greatest discussion arose as to the ability of the various trucks to negotiate the rise.

The writer had always had a preference for a certain type of battery through a belief in its ability to best withstand general abuse in the hands of unskilled operators, but this one troublesome incline finally made it necessary to give ground in favor of a battery of another type which, through its greater ability to meet sudden increases in unloading rates without permanent

injury, was the only one which seemed to meet the requirements. Certain it is that the decision seems to have been borne out by results, as capacity loads have been hauled up this incline for a year or more and the battery is apparently as good as ever.

The following factors seem to be essential to the successful use of power hauling in place of hand trucking in a field of miscellaneous production:

Don't take the salesman's word with regard to the unbeatable possibilities for economy within your plant through the adoption of mechanical haulage. It is not possible for a sales engineer in the course of a brief inspection of your layout to do more than uncover the more or less obvious things. The host of minor details, which have so great a part to play in the why and wherefores of a plant's routine, can only be learned after long and intimate contact.

Don't think that the installation for power hauling is going to eliminate the hand trucker. There will always be certain conditions, where expediency, sudden need or other limiting factors will make it advisable to use hand trucking. On the other hand, it is possible to cut out any men previously maintained for interdepartment service alone, and in large departments maintain a man for load shifting within that department. In the case of small shops this may usually be cared for by a general sweeper-trucker-roustabout.

Look beyond the actual trucking and realize that any truck can only give service in proportion to the efficiency and adaptability of its charging outfit. Too little attention has heretofore been given by the truckmaker to ascertaining that the purchaser of his truck had facilities for maintaining it at a point of high efficiency. Some day the truck folks are going to form a combine with the battery and charging equipment people, looking to this co-operative efficiency and then there'll be more trucks sold.

Get your truck maker to tell you frankly what real weaknesses your truck may have. He knows them, and if he's the right sort of chap and realizes that you appreciate that even the best of machines have weaknesses, he should be willing to tell you about them. Then cover yourself against possible tie-ups by laying in a small stock of spare parts to meet anticipated breakdowns.

## Recollections of an Old-Time Mechanic

By John J. Grant

The variety of home-made and make-shift equipment that made up Bill Clapp's machine shop in Northhampton (Mass.) was the best I had ever come across in my travels.

We had a suspension drilling machine that was one of the handiest tools I ever saw. Years ago I wrote an article on drilling machines for the *American Machinist* in which I described this drill. A tool of this description would be a valuable tool for shops doing large work at the present day.

We had one planer 24 x 24 in. x 6 ft., made by Gage, Warner & Whitney, Nashua, N. H. The architectural design was rather elaborate, but the machine designer was certainly abroad when the drawings were made (if there ever were any). We had more trouble to the square inch to make that planer behave than any tool I ever saw. The platen was continually running off the gear and tipping endwise to the floor. I finally made a sort of table at the end that prevented this. The elevating screw was in the center of the crossrail and after each raising it was necessary to set it parallel with the platen, with a surface gage. Of course, we changed it as seldom as possible, using long tools for the work.

There was one tool in the shop that stood out from all the others and had nearly all the refinements of tools of its class made today. This was a 42 x 42 in. x 10 ft. planer made by Slate & Brown, Windsor Locks, Conn. It was designed by Dwight Slate, one of the foremost mechanics of his day. I have often talked with him about this tool and it pleased him to have me enumerate its good points. It had the first friction feed box, afterwards applied to Pratt & Whitney planers.

We had a gear-cutting machine bought second-hand from the old Lowell machine shop. It was built on a wooden frame, had an index plate about 30 in. in diameter, and had been used so long that several of the rows of holes looked like grooves. Our gear cutters were all straight face, commencing with about 30 deg. included angle and guessed at for the lesser number of teeth. We filed most of the teeth in the gears to shape, often putting them on studs on a plate and running them together, getting the shape in that way. The only man who knew a thing about gearing was the patternmaker who used to shape the teeth by his eye.

We made gears that certainly ran well even though they were only "notches on the periphery," as Joe Renshaw at the Pratt & Whitney Co. used to call all badly cut gearing.

Our other tools were a bolt cutter, hand lathe and, of course, the usual grindstone under the stairs. At first it was difficult for me to grind a tool on account of the stone running out of true. I simply had to hold the tool solid on the rest and let the high places on the stone hit it when they came around, which by the way is often the case with the abrasive wheels in the shops of today.

After a few months in Old Bill's shop, the Civil War was declared and from that time on for the next three years, we were kept hustling. We did a large amount of work for the Government, such as gunbarrel drilling-machines, barrel-reaming machines, lapping and polishing machines and rolls for forging bayonets. Everything was on the jump and we certainly averaged fourteen hours per day during that time.

We had no addition to our equipment except such small tools as were actually necessary to produce the results called for by government inspectors. Old Bill fought the making of every tool and used to say: "You machinists ought to do anything with all the tools we have in this shop."

Most of the machines we made were well built and I would not be surprised to find many of them still in use at the Armory at Springfield, Mass. That shop did such an endless variety of work that it was no uncommon thing to see in the big lathe, a set of drivers from one of the Hinckley & Drury locomotives used on the Connecticut River R.R., and a man close by repairing a sewing machine. We had no specialists, every man was supposed to know how to handle every machine in the shop. No one man had a machine of his own but took any that was free at the time his job was given to him.

Of course, Old Bill's shop was a jobbing machine shop, and the greater part of it was used for that purpose, although we made standard machines, such as sawmills, waterwheels, and steam engines. It took skill, patience and perseverance to produce good work with such an equipment.

# Ideas from Practical Men

*Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.*

## Chart for Calculating Fit Allowances

A. D. SANGER

The tendency in manufacturing today is to work as close to the nominal dimensions for a part or parts as is consistent with the degree of accuracy necessary to the proper functioning of the parts and to the cost of producing. Any further degree of accuracy that is on either side of the standard established, is unnecessary and almost always costly.

From time to time various data have been published regarding this subject and it is not assuming too much to say that nearly every factory has its own individual system for establishing allowances, although several may manufacture the same product. Perhaps the closest attempt toward standardizing allowances for mating parts, has been made by the National Screw Thread Commission. Its investigations and recommendations show conclusively that it is not only possible to arrive at a standard that will be universal in application, but also that this scheme is practicable and desirable from several standpoints.

Years ago the Newall Engineering Co. made an attempt similar to the one conducted by the commission, but confined its endeavors to establishing suitable and practical working allowances for various classes of plain work. Its findings have been published in several handbooks, such as the "American Machinist Handbook," and a number of trade catalogs.

### Previous Tables Were Faulty in Methods of Grouping

The one objection to the tables for allowances that have been published, is the method adopted in compiling them, a method of grouping too many sizes or too many diameters for one set of allowances. If allowances closer than those tabulated are wanted, they must be estimated or arrived at by solving the formulas given, and these formulas are not always published.

To facilitate this work, the accompanying chart was designed and has been found successful, especially for diameters that are not specified in the tables. Reference to the chart shows that there are three scales, one containing the allowances in decimals of an inch, the second, which is a diagonal scale, giving the diameters of the parts to be made, and the third showing the classes of work.

The class of work scale provides a means for establishing allowances in accordance with the character of the work. This scale eliminates allowances that are too small and confines them to something close to a size that will produce a good working condition for the mating parts. An allowance that would ordinarily be permitted for close tool work or for gages would hardly be practical if applied to the same diameter of a part on an engine or motor. The conditions imposed upon the parts in these cases would, as a rule, be entirely different. Therefore, the allowance made for tool work would be too close for the latter and that which would be acceptable for engine work might prove to be too rough for tool work.

The system is based upon the theory that the hole is of a standard size and any allowance made for the shaft is to be deducted from the nominal diameter of that part. Also, the system recognizes the fact that cutting tools do not always cut to size, especially when new. Therefore, allowance is made for the variation of standard holes above the nominal size, so that when taking the allowance from the chart this value is to be added to the nominal size of the hole. For holes, the allowance is to be applied plus and for shafts, minus. The allowance for the holes is divided into two classes, one of which may be used for the working limits and the other for the inspection limits.

### Use of a Straightedge in Using the Chart

A few examples will illustrate the use of the chart. Let the diameter be 1 in. for the hole, in which is to be placed a shaft, the two making what would be termed an "easy" fit. The high and low limits of the shaft diameter are desired. With a straightedge connect Class IV on the class scale with the 1-in. diameter mark on the diagonal scale, allowing the straightedge to project beyond the allowance scale. Where this line intersects the allowance scale, read 0.0025 in. Now, further down on the right-hand scale is another Class IV. Connect this point with the 1-in. diameter mark, and on the left-hand scale, read 0.00125 in. We then have two limits, a high and a low, which means that the diameter may vary from 0.00125 to 0.0025 in. undersize. In actual limit dimensions this means that the shaft size would be specified thus, 0.99875 to 0.9975 in. The tolerance on the shaft will, of course, be the difference between the two limits, or 0.00125 in., and the initial clearance will be 0.00125 inches.

Let us assume another case wherein the shaft is to fit a 2-in. hole and the class of work required is that for fine tool work. Connecting VI with the 2-in. diameter mark the allowance is found to lie between 0.00125 and 0.0015 in. Therefore, we have a choice of either, or something in between, say 0.00135 in. Again connecting the lower VI with the diameter, the allowance is found to be 0.00075 in. Therefore, the shaft may vary from the nominal size, 2 in. by minus 0.00075 in. to minus 0.00135 in. The initial clearance being 0.00075 in. and the tolerance 0.0006 inches.

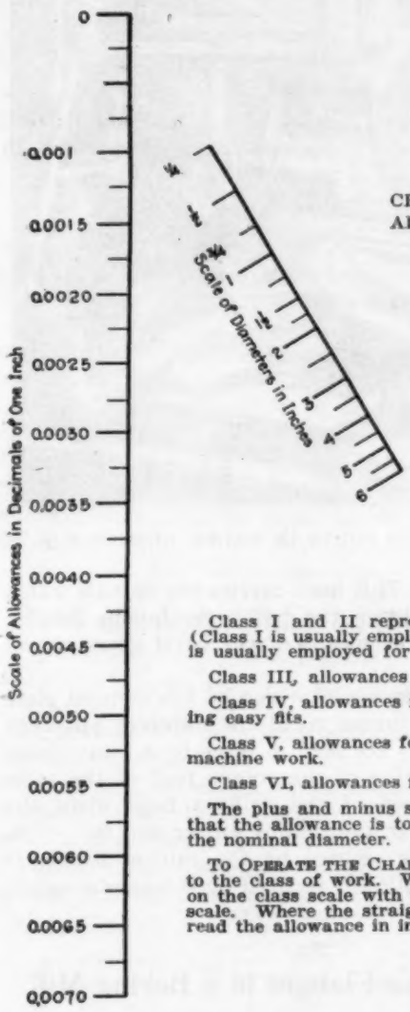
### Proper Attention to Working Limits an Aid to Inspection

Referring to the first example, that of a 1-in. hole, let us assume that it is desired to make an inspection gage for checking the hole; also a gage for the workman is wanted. If the working limits are held closer to the nominal size than the inspection limits we will

be assured that the inspection gage will accept all parts when they have been made to the working gage. Therefore, connecting the I and II marks on the class scale with the 1-in. diameter mark we find the allowance on the left-hand scale to be plus 0.0006 in. and plus 0.0008 in. respectively. If the former allowance is assigned to the working gage and the latter to the inspection gage we are permitted a variation from the standard size sufficient to compensate for the variation in tools and yet we obtain a hole that will not depart too far from the standard size.

The allowance for other sizes and classes of work are found in a similar manner. However, the allowance provided will depend upon the class of work, the character of the tool equipment and the machinery used and the conditions imposed upon the working parts. Therefore, even with the limits provided for by the chart, which are closer than the tabulated values given in tables, good judgment must be exercised by the designer or workman in establishing limits. As a rule, the whims or judgment of the one responsible for establishing tolerances is permitted, which results in a variety of dimensions, increases the chance for errors, and either increases the cost of the manufacture or causes difficulty in the assembling. A little thought concerning the chart will indicate wherein it can be advantageously used on most work in the drafting room.

CHART FOR CALCULATING ALLOWANCES FOR VARIOUS CLASSES OF FITS




Class I and II represent allowances for standard holes. (Class I is usually employed for working allowances; Class II is usually employed for inspection allowances.)

Class III, allowances for push fits.

Class IV, allowances for engine fits and other work requiring easy fits.

Class V, allowances for high-speed work and good, average machine work.

Class VI, allowances for fine tool work.

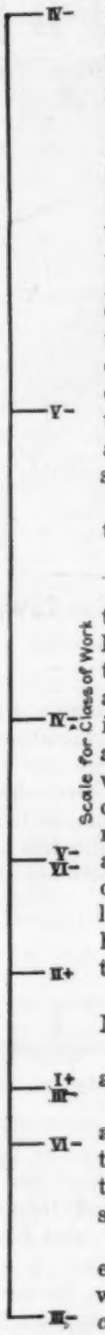
The plus and minus signs after the class numbers indicate that the allowance is to be either added to or deducted from the nominal diameter.

TO OPERATE THE CHART: Determine the fit required relative to the class of work. With a straightedge connect this point on the class scale with the nominal diameter on the diagonal scale. Where the straightedge intersects the allowance scale read the allowance in inches.

## What Are the Most Advantageous Angles to Give to Cutting Tools?

BY M. TOLLIVER

For some time past I have been making a study of the most advantageous angles to give to cutting tools, and I know of no better way than to look over articles in *American Machinist* dealing with this subject. I regret to say that I did not find as much as I expected, or maybe I should say that I found a great deal too much. This sounds a little involved but you will see what I mean from the following examples:




In *American Machinist* of Aug. 11, 1921, I find an article by Fred H. Colvin on tools for boring and turning locomotive tires. He illustrates the various tools used in various shops and gives their main elements. Considering that all of these tools are used in the same kind of a job and on the same kind of material one would expect them to be somewhat similar, at least in their essentials. Instead I find differences like this:

Hocking Valley, top rake 8 to 10 deg.

Wabash, top rake 2 deg.

One naturally asks what is the difference between the Hocking Valley and the Wabash that cutting tools should have a difference of 6 to 8 degrees in top rake. After puzzling for a little while on the whys and wherefores of this difference I came to the conclusion that it may possibly be a difference in artistic tastes of the presidents of the railroads, but this nice little theory was knocked in the head when I found in the same tabulation the following:

Grand Trunk, Battle Creek, Mich., top rake 8 deg.

Grand Trunk, Montreal, Canada, top rake, 18 deg.

This shows that it cannot be a matter of personal taste—on the part of the presidents but that it may possibly be the result of latitude.

I found so many other differences that I gave it up and I will ask other readers of *American Machinist* to solve the puzzle for me. A tabulation is at the end of this article.

I can see how different shops may have different cutting speeds or feeds. The reason may be that they have different machine tools with more or less power but why there should be a marked difference in the angles of tools is more than I can understand, and I wonder if the people who use the tools understand it themselves. One thing is sure in my mind. All of them

cannot be right and probably one of them is the best or may be the least worst. Possibly some of the gentlemen who decide on the nature of tools to be used for boring tires may be kind enough to enlighten me.

TABLE I—CONDENSED TIRE BORING TOOL DATA FROM SEVENTEEN RAILROADS

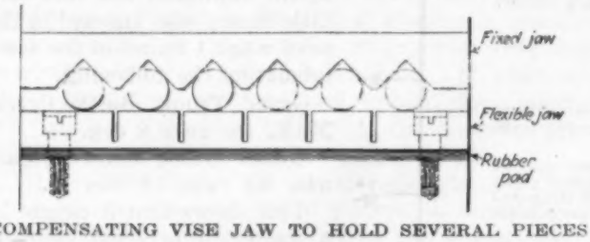
| Name of Railroad and Shop | Size of Tool Body, Inches | Top Rake of Tool, Degrees | Clearance at Point, Degrees | Cutting Speed Feet per Min. Roughing | Cutting Speed Feet per Min. Finishing | Feed per Revolution Roughing | Feed per Revolution Finishing |
|---|---|---|---|---|---|---|---|
| 1. Atchison, Topeka & Santa Fe, Topeka, Kans. | See sizes on drawing | 12 | 15 | 18 | 18 | ¼ | ¼ |
| 2. Chicago & Alton, Bloomington, Ill. | 1¼x1¼ | 8 | 6 | 25 | 25 | ¼ | ¼ |
| 3. Chicago & Northwestern, Chicago, Ill. | 1¼x1¼ | 12 | 10 | 15 | 15 | ¼ | ¼ |
| 4. Canadian Pacific, Montreal, Can. | 1 x1¼ | 6 | 6 | 14 | 12 | ¼ | ¼ |
| 5. Chicago, Rock Island & Pacific, Silvis, Ill. | 1¼x1¼ | 6 | 7 | 16 | 16 | 5/16 | ¼ |
| 6. Denver & Rio Grande, Burnham, Colo. | 1¼x1¼ | 8 | 6 | 16 | 20¼ | 5/16 | 5/16 |
| 7. Grand Trunk, Battle Creek, Mich. | 1¼x1¼ | 8 | 5 | 26 | 26 | 5/16 | 5/16 |
| 8. Grand Trunk, Montreal, Can. | 1¼x1¼ | 18 | 5 | 23 | 23 | 5/16 | 5/16 |
| 9. Hocking Valley, Columbus, Ohio | 1¼x1¼ | 8–10 | 7 | 40 | 40 | ¼ | ¼ |
| 10. Lehigh Valley, Bethlehem. | 1¼x2 | 7 | 8 | 12–20 | 12–20 | ¼ | ¼ |
| 11. Norfolk & Western, Roanoke, Va. | 1x1 | 4 | 6 | 18 | 18 | ¼ | ¼ |
| 12. New York, New Haven & Hartford, Readville, Mass. | 1x2 | 5 | 7 | 55 | 50 | ¼ | ⅛ |
| 13. New York Central, Depew, N. Y. | 1¼x1¼ | 4 | 4¼ | 24 | 24 | ⅛ | ⅛ |
| 14. New York, Ontario & Western, Middletown, N. Y. | 1x1 | 15 | 6 | 28 | 28 | 5/16 | 5/16 |
| 15. Pennsylvania, Olean, N.Y. | 1¼x1¼ | 2 | 7 | 19¼ | 19¼ | 5/16 | 5/16 |
| 16. Philadelphia & Reading, Reading, Penn. | 1¼x3 | 6 | 4 | 30 | 30 | 1/16 | 1/16 |
| 17. Wabash, Decatur, Ill. | 1¼x1¼ | 2 | 7 | 30 | 30 | ⅛ | ⅛ |

## Equalizing Vise Jaws

By S. A. McDonald

Trouble is often experienced in slotting the heads of screws when more than two pieces are being held in a vise at one time, due to slight variations in the diameters of the pieces. To overcome this trouble the vise jaws shown in the illustration were designed.

The fixed jaw is of usual construction. The equalizing jaw is made of tool steel and has a series of slots spaced so that they will come between the screws when




COMPENSATING VISE JAW TO HOLD SEVERAL PIECES

the jaw is in place. This jaw, after being drilled and counterbored for the fillister head holding screws, is hardened and drawn to a spring temper. A piece of ¼-in. rubber of the same width and length as the jaw is put in between it and the slide.

When the vise is tightened on the screws the rubber is compressed, exerting a pressure on the flexible jaw, bending it to meet variations in the size of the screws.

## Erratum

One of our readers has called our attention to an error in the article "Tools for Blanking and Piercing Watch Wheels," on page 114. The dimensions in Fig. 2 should have been given in millimeters instead of inches.

## Milling Ports in Valve Bushings

By I. B. Rich

Having a lot of valve bushing ports to mill and no large vertical milling machine to handle them on, the master mechanic of the Readville, Mass. shops of the New York, New Haven & Hartford railroad, rigged up an old vertical drilling machine as shown herewith. It was easier to get the blacksmith to forge up the frame *A* for the head of the milling spindle than to get a pattern made, which accounts for the forged head in-

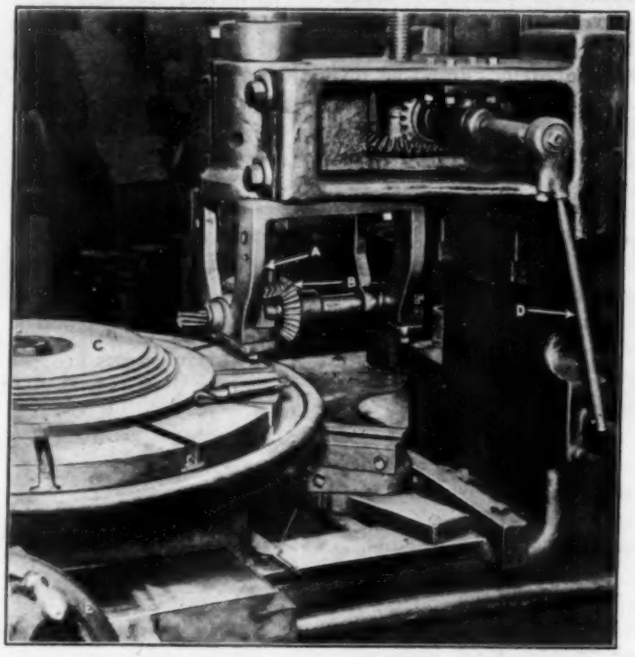



FIG. 1—MILLING PORTS IN VALVE BUSHINGS

stead of a casting. This head carries the spindle which drives the milling cutter, the drill press spindle driving the milling spindle by means of the bevel gears shown at *B*.

The valve bushings are centered on the stepped plate *C*, the steps being turned to fit the different bushings used. The bushings are held in place by a long center bolt. The combination of the rotary feed of the table and the vertical feed of the drilling head gives the desired movements to the milling cutter and the work. The vertical feed is secured by the ratchet handle *D* while the rotary motion is secured by the handwheel *E*, shown in the lower left-hand corner.

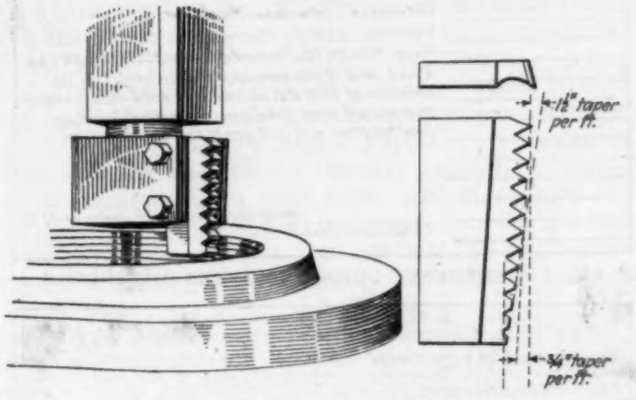
## Threading Pipe Flanges in a Boring Mill

By Joe V. Romig

Having a large quantity of cast-iron flanges for pipes to machine, we equipped a boring mill, as shown in the illustration, to do the work. On this machine more than one operation could be carried forward at the same time, thereby gaining considerable time over the lathe with its single point cutting tool.

The flanges were first faced off and properly recessed upon the joint surface, then turned over for boring and threading in the manner described. The mill was provided with a friction feed that could be adjusted to any desired relative advance. A chaser was made and

fitted to a suitable holder as shown, and the feed adjusted as nearly as could be calculated to the required pitch. With the work revolving, the chaser was fed into the hole by power with the tips of the chaser teeth just touching the work, the light line thus made serving to show when the rate of advance was right and enabling the operator to make minor corrections. The chaser would then be withdrawn, the head moved by means of the cross-screw and micrometer dial to




CHASING A THREAD IN A BORING MILL

give the exact depth of cut, and the chaser run through the hole, thus cutting the thread to required depth in one pass. As the cut proceeded the head would be moved slowly toward the center to give the thread the necessary draft.

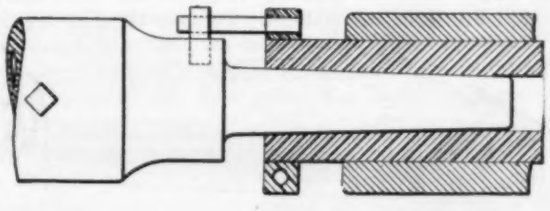
The chaser was made in the shaper by swiveling the vise to correspond with the helix angle and tilting it slightly forward to give the necessary clearance. One of the requisites of a free cutting chaser is the lip, which I have tried to show as clearly as possible in my sketch.

## Holding a Drill Chuck on the Tail Spindle of a Lathe

BY CHARLES KAUFMANN

To prevent a chuck from wringing loose when it is used in the tail spindle of a lathe, as in drilling, make a clamp ring as shown in the sketch to fit over the tailspindle and provide it with a pin extending horizontally to contact with a pin in the chuck body.

This is simple and easy to make, will not mar the spindle, and will save a great deal of annoyance when



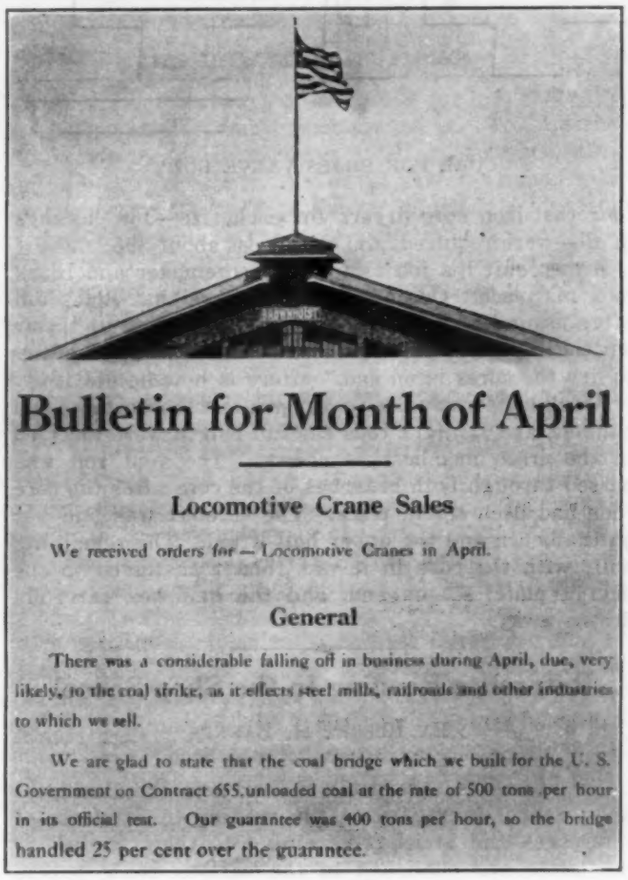
KEEPING A CHUCK FROM WRINGING LOOSE

using a drill chuck in this manner. Do not forget to make the head of the clamping screw in the ring the same size as the toolpost screw, so that you will not have to hunt up a wrench every time it is necessary to adjust it.

## Keeping the Shopmen Interested in the Company

BY HERBERT CRAWFORD

The Brown Hoisting Machinery Co., Cleveland, Ohio, believe that men are more interested in their work and in the company, if they are kept posted as to what they are making and as to how it performs. One method of doing this is shown in the bulletin reproduced herewith. The company also posts blueprints showing the main features of new cranes or hoists with the general dimen-



**Bulletin for Month of April**

**Locomotive Crane Sales**

We received orders for — Locomotive Cranes in April.

**General**

There was a considerable falling off in business during April, due, very likely, to the coal strike, as it effects steel mills, railroads and other industries to which we sell.

We are glad to state that the coal bridge which we built for the U. S. Government on Contract 655, unloaded coal at the rate of 500 tons per hour in its official test. Our guarantee was 400 tons per hour, so the bridge handled 25 per cent over the guarantee.

ONE OF THE SHOP BULLETINS

sions and special features clearly shown. These prints also tell what the machines must do and give other interesting details. Similar methods can be used to advantage in almost any shop.

## Two Ways of Making a Core

BY M. E. DUGGAN

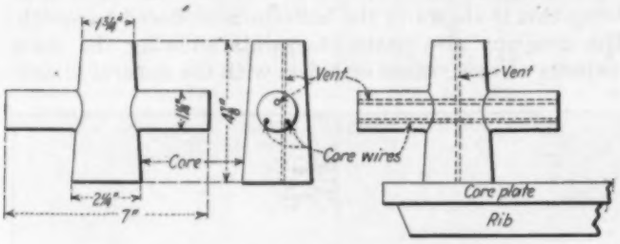
In casting a brass valve body a core, as shown in the accompanying illustration, was used. There were several sizes of this valve, the only difference being in the dimensions, and cores had, of course, to be made for all.

When in doubt as to just how best to make a pattern or corebox I usually consult with the molder or coremaker, or both, and as a rule I accept their "say so" as final. However, there are times when they too make mistakes; some of them costly.

The core here shown should interest patternmakers for the reason that the practice of "drying on end" is the subject of some controversy. I doubt if there are

many patternmakers sufficiently well informed on core-making practice to give a positive answer to the question "Is this method practicable and economical?"

Brown was the boss coremaker in the foundry where these valves were to be produced in large quantities. In order to produce a perfect core and at the same time speed production, Brown decided that a set of twenty-




CORE FOR BRASS VALVE BODY

four cast-iron core dryers for each size—168 castings in all—were required, and these cost about $95.

Brown quit his job as foreman coremaker and Black took his place. One of the first things that Black did after assuming his new responsibilities was to throw out the 168 dryer castings because, as he said, "the way to dry the cores is on end." Here is how he did it.

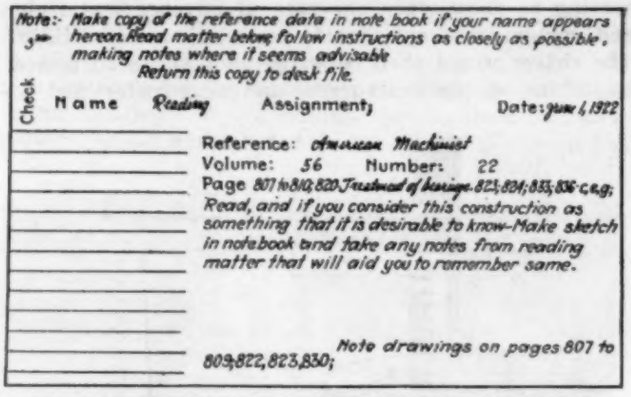
A full core was made in an open end box in the usual manner, and straight rods cut full length were inserted in the cross members as shown. The vent rod was passed through both branches of the core after the core rods had been set in place. The corebox was laid flat on the bench and the upper half lifted. The remaining half, with the core in it was then transferred to the drying plate, set on end, and the half box carefully drawn away.

## Reference Reading in the Shop School

BY ROBERT H. BARNES
Instructor of Drafting, Rochester Shop School

An outline of the system followed in the Rochester Shop School in regard to the reading by students of references and articles pertaining to their studies as the latter are published in the various trade papers and technical publications, is presented herewith.

The magazines are preserved in binders that allow the addition each week or month of the numbers as they appear. After the advertising pages have been duly read and digested by those interested, they are removed and the editorial section preserved in the binders. A printed plate or form corresponding to the

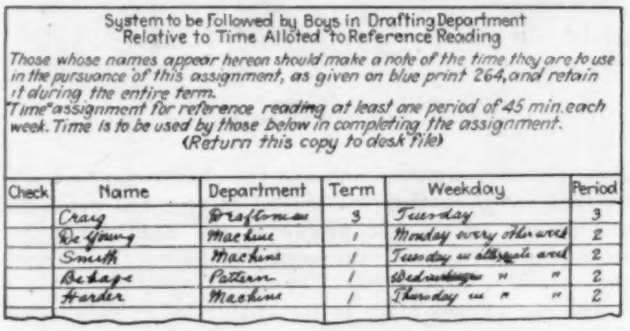

Note: Make copy of the reference data in note book if your name appears hereon. Read matter below, follow instructions as closely as possible, making notes where it seems advisable.
Return this copy to desk file.

Check | Name | Reading Assignment | Date: June 6 1922

Reference: American Machinist
Volume: 56 Number: 22
Page 807 to 810; 820. Instead of drawings 822, 824, 833, 836 c.e.g;
Read, and if you consider this construction as something that it is desirable to know-Make sketch in note book and take any notes from reading matter that will aid you to remember same.

Note drawings on pages 807 to 809, 822, 823, 830;

FIG. 2—REFERENCE FORM ON COVERS OF BINDERS


System to be Followed by Boys in Drafting Department Relative to Time Allotted to Reference Reading

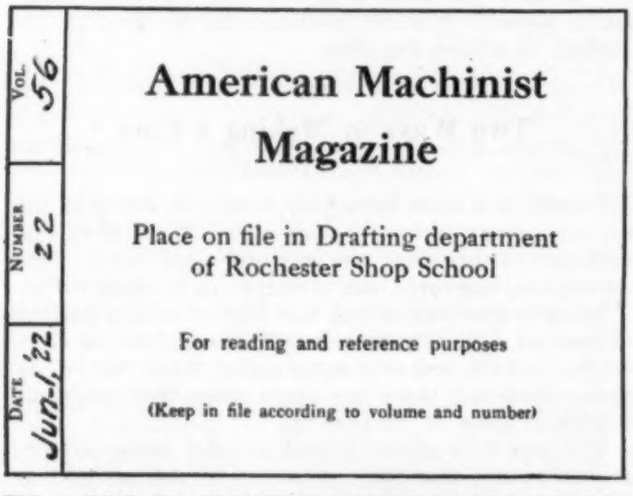
Those whose names appear hereon should make a note of the time they are to use in the pursuance of this assignment, as given on blue print 264, and retain it during the entire term.
Time assignment for reference reading at least one period of 45 min. each week. Time is to be used by those below in completing the assignment.
(Return this copy to desk file)

| Check | Name | Department | Term | Weekday | Period |
|---|---|---|---|---|---|
| | Craig | Draftsman | 3 | Tuesday | 3 |
| | De Young | Machine | 1 | Monday every other week | 2 |
| | Smith | Machine | 1 | Tuesday on alternate week | 2 |
| | Bebage | Pattern | 1 | Wednesday " " | 2 |
| | Harder | Machine | 1 | Thursday " " | 2 |

FIG. 3—ASSIGNMENT LIST OF STUDENTS

magazine is pasted on the cover of each binder, the one shown in Fig. 1 being for the *American Machinist.*

The forms represented in Figs. 2 and 3 are also pasted on each cover and these are filled out by the instructor, directing the attention of certain students to definite articles in the magazine that it is desired to have them read. Upon reading the specified article a student passes the volume along to him whose name appears next in line, after placing a check mark before his own name to indicate that he has completed the assignment.


VOL. 56
NUMBER 22
DATE Jun-1, '22

American Machinist Magazine

Place on file in Drafting department of Rochester Shop School

For reading and reference purposes

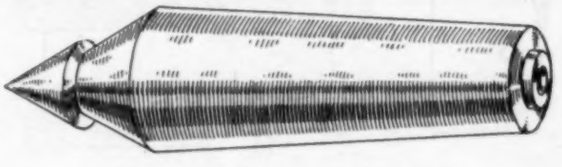
(Keep in file according to volume and number)

FIG. 1—BOOK PLATE USED IN ROCHESTER SHOP SCHOOL (BLUEPRINT 264)

## Saving Time in Grinding Centers

BY CHARLES KAUFMANN

The centers of the average engine lathe are many times larger than is actually required by most of the jobs that are done upon them. To save time in regrind-



A TIME SAVER FOR THE TOOLROOM

ing hardened centers it will pay to fit each lathe with an extra pair, made as shown in the sketch.

In this way the grinding wheel does not have to cut away a lot of extra metal every time the centers are trued, and the time thus saved will soon pay for the making of this extra equipment.

# Editorial

## Relative Turnover Rates

ACCORDING to the 1919 Census of Manufacturers, the value added by manufacture to the products of the whole country was slightly less than one and a half times the capital invested. In other words American business as a whole turns its capital approximately one and a half times a year. Further investigations show that the machine-tool industry succeeds in turning its capital only a little more than nine-tenths of one time in a year. Bear in mind that the period under discussion, 1914 to 1919, includes the war years when the industry was making such "fabulous" profits.

It is almost axiomatic that the surest road to commercial success is through small profits and rapid turnover. Apparently the machine-tool builders have endeavored to follow only the first part of the road, the small profit section, without sufficient attention to the second. We say "apparently" because as a matter of fact it is next to impossible, under present conditions, to increase the rate of turnover.

In the long run there seems to be only one way for the machine-tool industry to keep up with the procession. If the rate of turnover in that industry is of necessity less than the rate for other industries, then it is certainly logical to expect a greater return on each turnover provided the whole business is not to be conducted as a philanthropic enterprise.

## Encouraging the Manufacturer

WHEN a political campaign impends and the sinews of war are in demand there is much talk of encouraging the manufacturer, protecting him from foreign competition, the good of the community, and so on. Many of the arguments used to support the iniquitous tariff bill now before the Senate are based on such reasoning.

In between times, however, the encouragement sometimes assumes a rather negative character. Take for instance the case of an old New Hampshire machinery concern which was recently visited by state assessors with the result that the valuation of its property was increased ninety per cent. In all probability the assessors were honestly applying the law of the state in making their valuation, but the result of their action is detrimental not only to the state but to the community in which this plant has been an important factor for many years.

The company in question has purchased a factory site in a Middle-Western state near one of the big steel centers, and one that is served by several trunk line railroads. Eventually the old plant will probably be closed, with a loss not only to the state in the matter of taxes but to the community in the elimination of a live industry employing many men, who will be compelled to seek work elsewhere and take their trade from the merchants of the town.

The puzzling part of the situation is that the same legislative encouragers who are so willing to make promises before election are the ones responsible for the kind of taxation law which works so badly for the people they are supposed to represent.

## Business and the Artist

THE artist has always been famous for his ignorance or disregard of hard business facts. To him the satisfaction of achievement, of creating some beautiful thing in marble, on canvas or in metal, is sufficient recompense for the hours of hard work put in. The real artist seldom realizes the true value of his work, and puts entirely too low a price upon it. His customers are only too glad to accept his valuation and profit accordingly.

The "practical" man who builds the machinery which makes possible the present scale of living would be the last to consider himself an artist, and yet he answers every item of the description except that sometimes his work is not exactly beautiful according to accepted standards of beauty. One of the best of modern American painters, a man who has given much thought to the psychology of the artist, maintains that the only difference between the painter and the mechanic lies in the medium used by each to express his ideas.

The artistic spirit of the mechanic is typified in the remark made to us by the president of a firm of machine tool builders just after the successful introduction of a new design. He said, "Aside from the commercial value of this tool there is a very real satisfaction in having finally achieved an ideal we have had for years." Judging from the price he put on the tool he is likely to get most of his returns in satisfaction rather than in cash. A trus artist, the mechanic, but not much of a business man.

## Unemployment Insurance

IN TWO STATES bills are being advocated to make unemployment insurance compulsory on all manufacturers. Undoubtedly similar laws will be proposed in other state legislatures this autumn.

The subject of unemployment insurance holds out alluring possibilities to the humanitarian, the socialist, the college professor and other well-meaning individuals who are not hampered by the unpleasant functioning of economic laws. In most cases their motives in advocating such legislation are above reproach, but not so their knowledge or acceptance of inescapable economic facts.

To bring the unemployment insurance question squarely before the machinery industry we have two articles in this issue, one on the economic phases of the problem and the other on the private and public efforts to solve it both in this country and in Europe. They merit careful reading as a rigid enforcement of such acts as the Wisconsin Bill of 1921 would do untold harm to the industry.

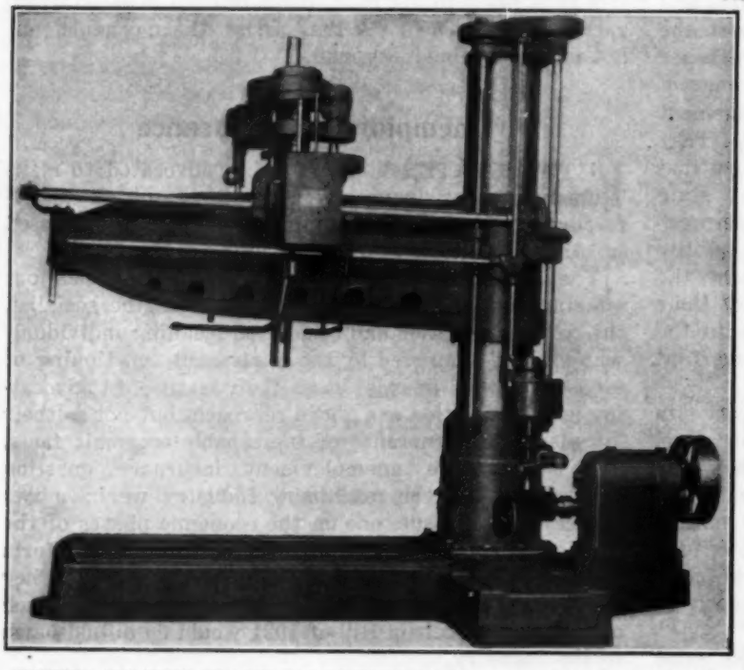
# Shop Equipment News

## Power Clamping Device for Column of Dreses Radial Drilling Machine

In order to eliminate the necessity for the operator of a large radial drilling machine leaving his place at the head to tighten the column carrying the swinging arm at each shift of the drill, the Dreses Machine Tool Co., Cincinnati, Ohio, has just placed on its machines a device for clamping by power. The clamp is controlled from the head. No air pressure is required for the device, so that it is not necessary to have piping and air hose brought to the machine.

A rear view of a radial drilling machine equipped with the power clamp is shown in the accompanying illustration. The device is driven from the main vertical driving shaft, which extends through the small oval box at the rear of the column. Two friction clutches in the box are incorporated in the drive, so that the screw below the box can be run either right- or left-handed. On this screw there is a nut that operates a forked lever. The hub of this lever is tapped and threaded on the binding screw of the column, so that the column is clamped in position when one of the clutches is engaged.

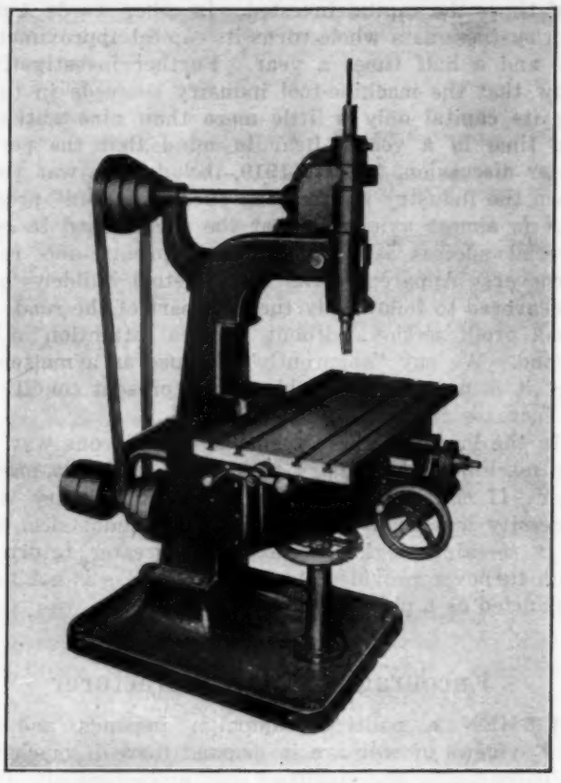
Engagement of the friction clutches that operate the screw is accomplished by means of a cam on top of the box. This cam is attached to the vertical splined shaft, which is geared to the horizontal splined shaft at the back of the arm. The links and the hand lever attached underneath the head move with it, and can be employed to operate the mechanism and clamp the column. The friction clutches are self-releasing and slip at either end of the movement of the tightening lever, preventing injury to the parts by over-running.



POWER COLUMN CLAMP ON DRESES RADIAL DRILLING MACHINE

## Robbins Profiling and Milling Machine

The Robbins Machine Co., 42 Lagrange St., Worcester, Mass., has just placed on the market a vertical-spindle profiling and milling machine, shown in the accompanying illustration, that is somewhat different from the conventional design.



ROBBINS PROFILING AND MILLING MACHINE

The work table has a surface of 16 x 30 in. and the throat depth from the center of the spindle to the face of the column is 14 in., thus accommodating comparatively large work for this type of machine. The table traverse is 12 in. and the cross movement 7 in. The knee may be moved vertically a distance of 6 in. and there is a vertical movement of the spindle of 2¾ in., operated by a rack and pinion.

The crossfeed screw is operated through helical gears from a handwheel that stands in the same plane as the traverse handle, thus making it convenient for the operator to manipulate both movements simultaneously. The end of the cross screw is squared to carry a crank handle in the usual position if desired.

The spindle is 1⅞ in. in diameter and takes a No. 3 Morse taper shank. A through hole provides for the use of a knock-out rod. The spindle runs in three parallel bearings of bronze, each 4 in. long, by which it is held rigidly in alignment. The drive is through gen-

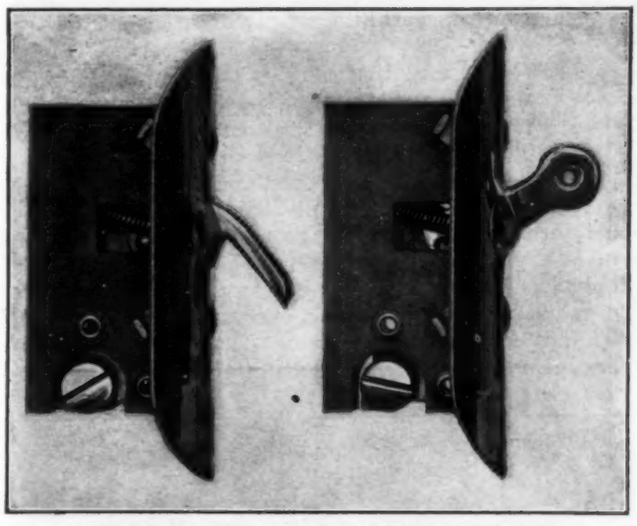
erated bevel gears from a shaft having a four-step cone to provide speed changes.

The normal height of the table from the floor is about 36 in., and the maximum distance from the table to the lower end of the spindle is 9 in. The machine occupies a floor space of 36 x 45 in. and weighs 1,100 pounds.

## Cutler-Hammer Tool-Handle Switches

Two types of compact electric switches for use on small tools and appliances have recently been placed on the market by the Cutler-Hammer Manufacturing Co., Milwaukee, Wis. The view on the left of the accompanying illustration shows a momentary-contact type of switch for installation in the handle of such tools as portable drills. The switch is usually so placed that when the tool is gripped the forefinger of the operator rests on the trigger, so that the current can be easily turned on. A spring causes the trigger to return to the off position, so that when the grip is released the switch automatically opens the circuit.

The switch shown on the right of the illustration is of different form, and is provided with an operating



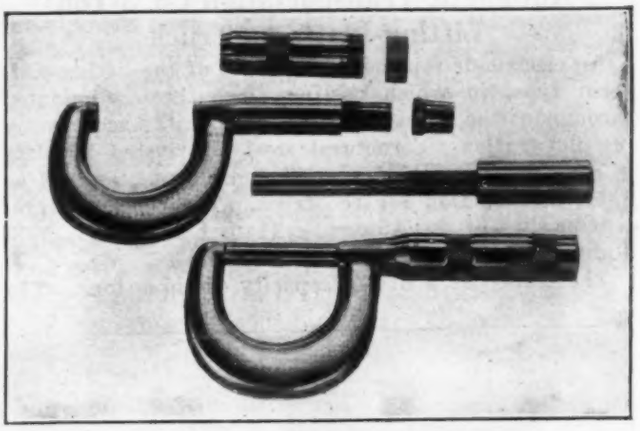
CUTLER-HAMMER TOOL-HANDLE SWITCHES

lever, but no spring to return this lever. The switch is for use in appliances where it is desirable that the switch remain in either the off or the on position until the lever is moved to the other position by the operator. The devices are provided with long phosphor-bronze contacts which engage with a wiping motion.

## Jaques Special Micrometer

A micrometer, designated as the "Jaques Special," has just been brought out by the Central Tool Co., Auburn, R. I. It is shown in the accompanying illustrations, the lower view giving the tool assembled and the upper one the component parts. All the parts are shown separately, except that the measuring spindle and its sleeve, which appear as one piece, are two pieces pressed together.

The frame is of oval section and is one piece with the barrel. The outer end of the barrel is split to provide means of compensating for wear of the thread, and the adjustment in diameter is made by the spring nut which may be seen adjacent to the barrel. The thimble is a tight push fit over the sleeve of the measuring spindle and it is also split and provided with a knurled ring nut for clamping it to the sleeve.



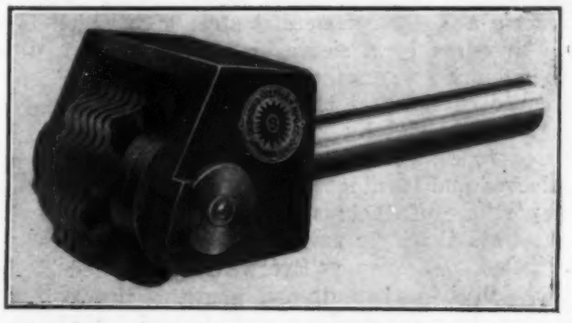
JAQUES SPECIAL MICROMETER

The micrometer may be dis-assembled, the adjustments made, and then reassembled in a few seconds with no tools other than the operator's fingers. After the adjustment is completed, the spindle is run into contact with the anvil, and the thimble turned or moved endwise, or both as may be necessary, to bring the zero lines into coincidence. After the outer ring nut has been tightened, the micrometer is ready for use.

## Desmond-Stephan Roller Bearing Grinding-Wheel Dresser

The accompanying illustration shows a rotary type of grinding-wheel dresser that has recently been placed on the market by the Desmond-Stephan Manufacturing Co., Urbana, Ohio, in which device the tool-steel disks are carried on roller bearings. The advantage of the construction is the easy running of the disks and the long life of the bearing. It is stated that on a continuous run of 15 hours the bearings showed no wear, and the cutters showed a loss in diameter of $\frac{3}{16}$ inch.

A stud $\frac{3}{4}$ in. in diameter carries a cage holding the rollers of the bearing, which in turn support a bushing



DESMOND-STEPHAN ROLLER-BEARING DRESSER

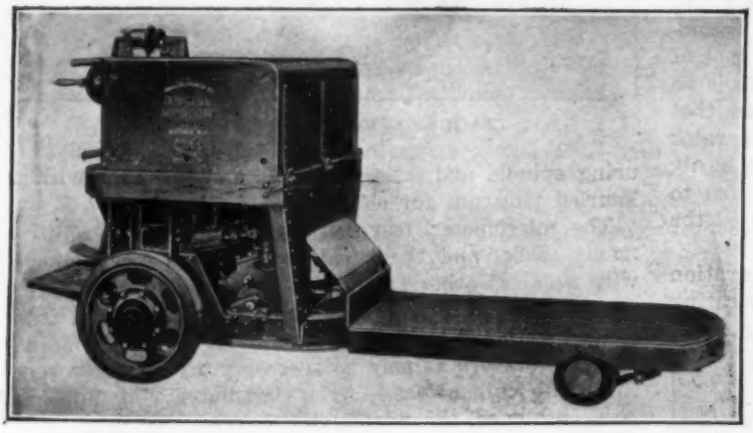
on which the cutters are securely fastened. The construction makes the bearing dust-proof, but provides means of oiling it. The cutters have a corrugated form, are $2\frac{3}{4}$ in. in diameter and may be replaced when worn.

The body of the device is so made that it is applicable to use either in a toolpost or on a magnetic chuck. The shank is employed to hold the dresser in a toolpost; for use on a chuck, the device is turned over from the position shown in the illustration, so that both the top of the body and the end of the shank rests on the chuck table.

## Automatic Transportation Co. 3-Ton Lifting-Platform Truck

An electric-driven industrial truck of the lifting-platform type, in which castings have been eliminated throughout the framework, is shown in the accompanying illustration. Structural steel hot-riveted in place is employed to provide a rigid and durable, as well as light, construction for the truck. The truck is a recent product of the Automatic Transportation Co., 2933 Main St., Buffalo, N. Y.

The truck has a lifting capacity of three tons. The



"AUTOMATIC" 3-TON LIFTING-PLATFORM TRUCK

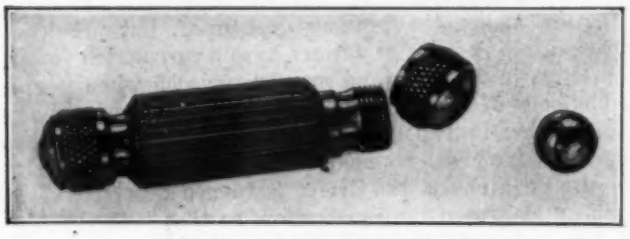
battery, the motor, the drive mechanism and the control mechanism are similar to those employed on previous models of this company's trucks. Steel covers enclose the batteries and all of the auxiliary mechanism.

## "Everwear" End Test Gage

An end gage for testing micrometers or for use in quantity production of work requiring the accurate gaging of internal diameters, is a recent product of the Central Tool Co., Auburn, R. I. The gage is herewith illustrated with the cap and ball removed from one end to show the construction.

The central part, or stem, is cupped at both ends to receive a ⅛-in. commercial steel ball, which is retained in place by a sleeve or cup threaded to screw on the stem.

Because of the fact that the actual measuring contacts are provided by round balls, the gage may be adjusted to compensate for wear by merely loosening the sleeves and turning the balls slightly to expose unused portions of their surfaces. After several such adjustments the balls may be discarded and new ones substituted. The name "Everwear" is applied because of the ability to maintain the length of the tool. The gage can be furnished in any desired length above 1 inch.



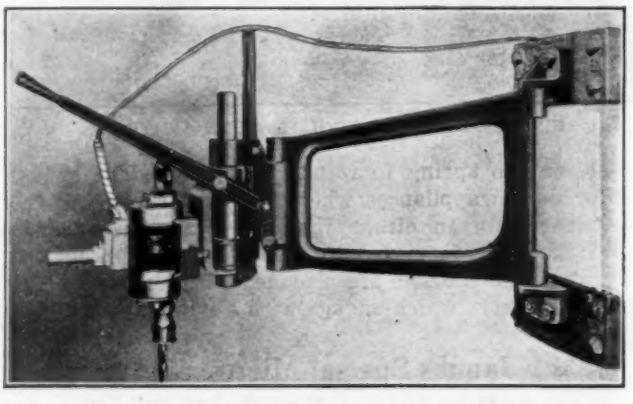
"EVERWEAR" END TEST GAGE

## Van Dorn Radial-Arm Electric Drill for Millwrights

In order to provide an electric drill especially adapted to the needs of millwrights and maintenance men, the Van Dorn Electric Tool Co., Cleveland, Ohio, has recently placed on the market the "millwrights' special" radial-arm drilling machine that is shown in the accompanying illustration. The device can be attached to the wall or to a column for performing jobs of a stationary nature where rigidity and greater accuracy are required than can be obtained by holding the drill in the hands.

The power-driven unit of the machine is essentially a portable electric drill of the type formerly made by the concern. The housing is of aluminum; the whole tool is light in weight, and the parts are arranged to permit quick dismounting for greasing and cleaning. The motor is of the universal type, adaptable to both a.c. and d.c. circuits. It is ventilated by means of an aluminum fan on the rotor shaft, which latter is equipped with ball bearings. The drill chuck holds twist drills up to ⅝ in. in diameter for work in iron and steel, while larger bits can be carried for boring wood.

The arm that carries the drill is light in weight so that it can be easily swung on its pivots or carried to different parts of the shop. Two brackets are bolted to the wall or column to carry the pivots that support the arm. At the outer end of the arm is a second pivoted joint on which the short forearm swings. The outer portion of the forearm is a support and guide for the bracket carrying the drill. The portable drill can be quickly attached to the radial arm by removing one handle from it and bolting it to the adaptor plate. It is stated that less than one minute is required to attach and detach the



VAN DORN RADIAL-ARM ELECTRIC DRILL

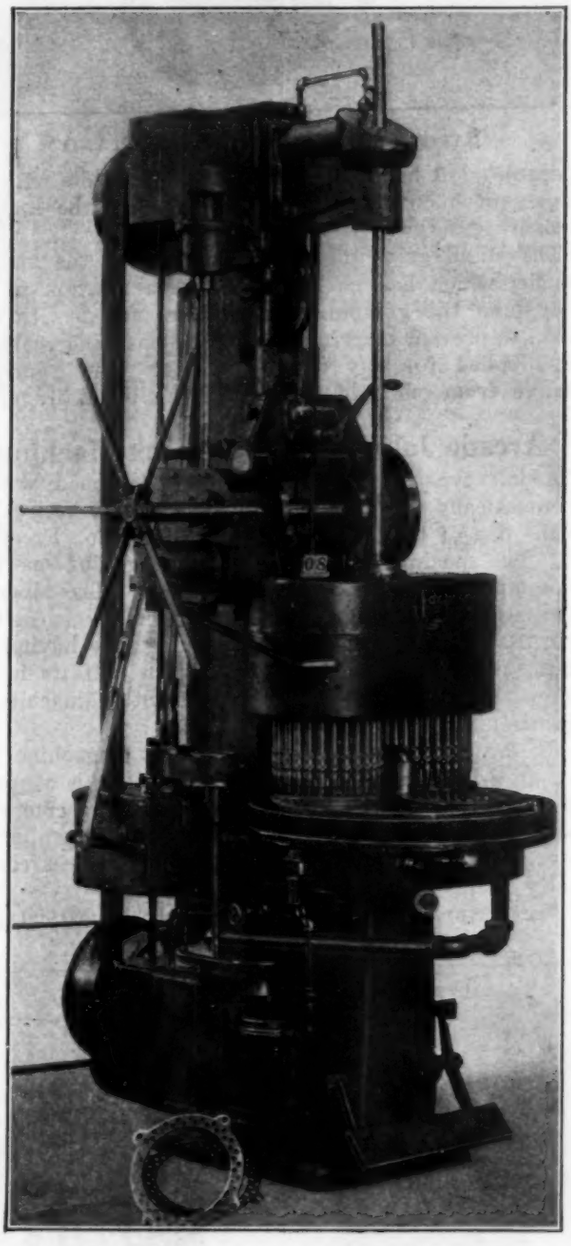
drill from the arm, thus making the machine available for portable drilling operations.

The drill bracket or vertical sliding members can be operated by means of the long hand lever. A tension spring attached to the bottom of the drill bracket counterbalances the weight of the drill. The area of operation for the cutting tool lies within a circle having a radius of 31½ in. from the wall pivots. The auxiliary forearm provides a secondary radius of 10½ in. that permits of varying the distance of the drill from the pivot, and enables locating it over the work.

## Fox No. 12 Automatic Countersinking Machine

A single purpose machine designed for such work as countersinking automobile clutch plate holes has just been introduced by the Fox Machine Co., Jackson, Mich. As arranged for countersinking the fifty-two holes in Hudson clutch plates it is a three-station, rotary-table machine with twenty-six spindles in each of two groups mounted in a single head as illustrated.

The speed box on top of the column is similar to the one used on other Fox machines, but the feed box, on the left in the figure, has but one fixed movement



FOX AUTOMATIC COUNTERSINKING MACHINE

instead of the usual changes through sliding gears. The vertical shaft which drives the spindles is driven by a bevel gear from the front of the speed box. The other vertical shaft shown, coming from the feed box, drives the cams through which the spindles get their up-and-down motion of ½ in. A clutch is provided so that the feed can be released or engaged at will.

The shaft with universal joints at both ends transmits power from the feed box to the table indexing mechanism which indexes the table 120 deg. through a modified Geneva motion. The tripping is done by the upward movement of the head.

The countersinks float so that any small irregularity in the spacing of the holes in the work may be taken up. Each spindle has a vertical adjustment graduated to 0.005 in., and a positive lock.

Forced lubrication of the spindle bearings and spindle head gears is provided by a geared pump located in the head. A feature of the design is an arrangement which prevents oil from running down the spindles. The drilling compound is carried in the forward compartment of the lower tank and is forced up through the center of the table to flow out over the entire work surface. The pump is belt driven from the indexing mechanism drive shaft, as is the pump which forces the lubricant to the speed box gears and which is located in the rear compartment of the tank.

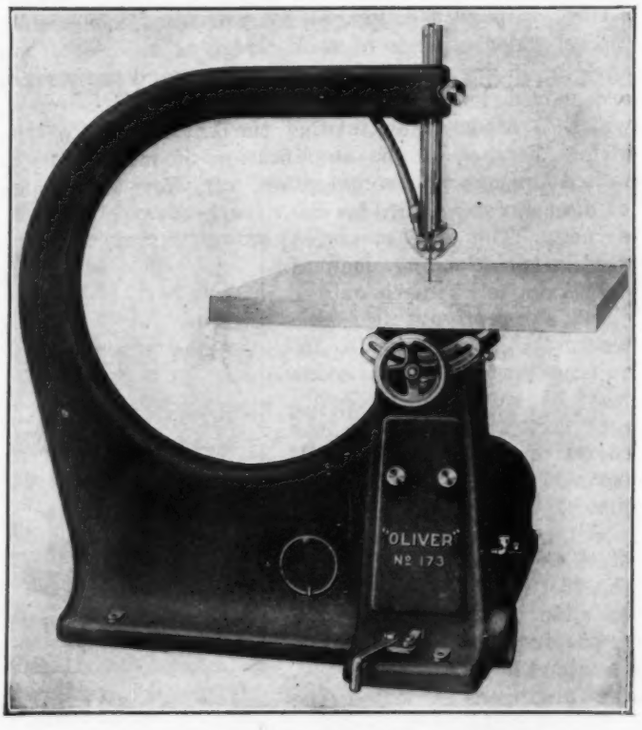
The machine is started up at a rate of ten cycles per minute or a completed plate every six seconds. This arrangement gives the operator plenty of time to change pieces at the loading station and higher production is expected when he becomes more familiar with the machine.

Initial drive is through an automobile type dry disk clutch at the top of the column and controlled by a foot lever at the base of the pedestal. The weight of the machine is 2,450 pounds.

## Oliver No. 173 Self-Contained Jig Saw

A self-contained jig saw known as No. 173 has just been placed on the market by the Oliver Machinery Co., Grand Rapids, Mich. The machine is designed for all kinds of interior and exterior scroll work made of wood or other substances of similar machineability.

As will be seen from the illustration no moving parts




OLIVER SELF-CONTAINED JIG SAW

are exposed except the saw. The fact that the saw is mounted in such a way that it is not under tension is also claimed to add to the safety of the machine. An automatic clamping device below the table operating in conjunction with the sliding block above makes the changing of blades an easy job. The pitman and crosshead are made of aluminum to reduce the weight of reciprocating parts.

The cast-iron table is 39 x 34 in. and may be tilted to an angle of 30 deg. right or left. It is possible to rotate the saw guides 90 deg. in their bearings so that the work may be fed either from the side or the front. The foot control is arranged to be operated from either position.

A slide in the table may be withdrawn by means of a knob on its under side to allow chips and small pieces to drop through the table out of the way. A continuous air blast is directed at the front of the saw to carry away dust.

The speed of the shaft is 1,200 r.p.m. and a flexible coupling is provided to connect it directly with the motor. Belt drive can be provided if desired. The stroke of the saw is 3 in, and saws up to 18 in. long may be used. From the saw to the column there is a clear opening of 36½ in. but longer work can be fed from the side as indicated above. The highest work that can be taken under the guide is 10 inches.

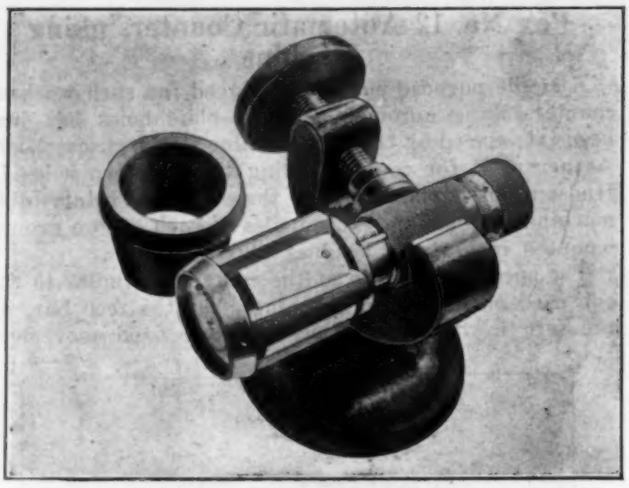
One dozen saws and the necessary wrenches are furnished with the machine.

## Bath Inspection Gage and Stand

The inspection gage and stand shown in the illustration has recently been brought out by John Bath & Co., Inc., Worcester, Mass., and is intended for facilitating the calibration of accurate internal diameters in hardened and ground work. The gage is a modification of the Bath internal micrometer that measures internal diameters by means of a combination of a micrometer screw and sliding wedges, which micrometer was described on page 578, Vol. 54, of *American Machinist*.

The under surface of each wedge is inclined at an angle of 15 deg. to the body of the tool, and the wedges are moved longitudinally by the micrometer screw, which is actuated by turning the knurled end of the stem. Because of the amplification of movement obtained through the combination, very fine increments of diameter can easily be discerned. The tool measures readily variations as small as 0.0001 in., each mark on the thimble representing this amount. Measurements involving portions of divisions may be estimated as easily and accurately as upon the corresponding 0.001 in. divisions of the standard micrometer.

A tapered ring of hardened steel at the entering end of the tool enables the inspector to slide the work upon the measuring surface easily while the stand holds the tool firmly. the arrangement leaves the operator's left hand free to handle work, while with the fingers of his right hand he manipulates the knurled measuring screw.



BATH INSPECTION GAGE AND STAND

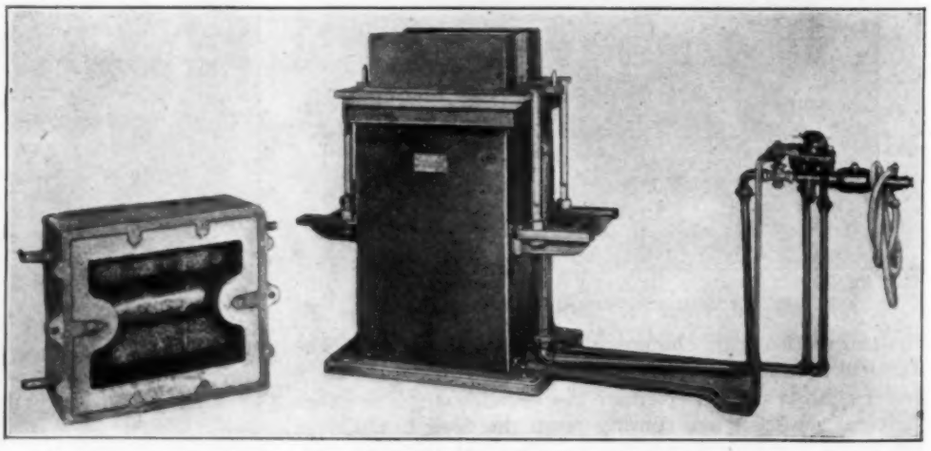
The stand grips the measuring tool by the knurled handle, which has no movement with relation to the body, and the gripping surfaces are faced with soft metal to prevent marring the tool. Measuring tools can be supplied for any diameter above 1 in., and the change from one size to another can be easily made.

## Arcade Jolt Stripper Molding Machine

A jolt type of molding machine equipped with a pneumatically operated stripper has recently been added to the line of the Arcade Manufacturing Co., Freeport, Ill. The machine has a 6-in. jolting motion operated by compressed air in the usual manner. The air-operated stripping motion can be furnished with either 8 or 12 in. length of stroke. The machine having the 12-in. stripping motion is placed with half its height below the floor level, but the 8-in. strip machine is placed entirely above the floor.

The accompanying illustration shows a machine having an 8-in. stripping motion. A pattern is mounted on the jolting table, and a flask containing a completed mold is shown on the floor at the left of the illustration. The arrangement of the operating valves can be easily seen.

The stripper frame which carries the vertical pins



ARCADE JOLT STRIPPER MOLDING MACHINE

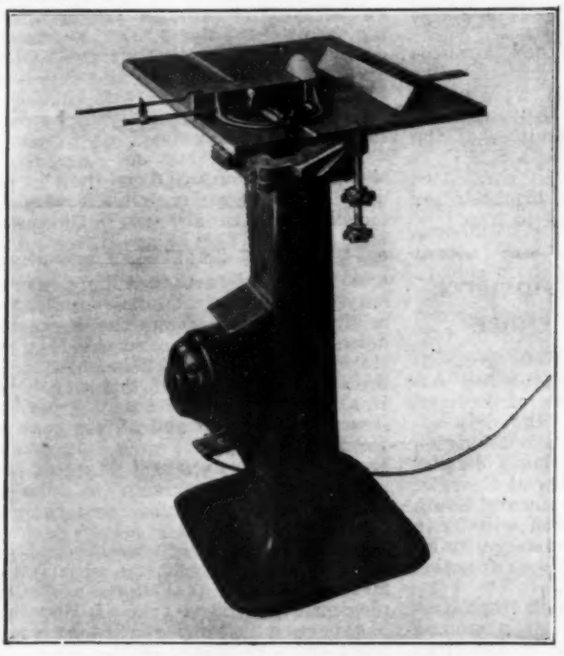
that engage the stripping plate, or that lift the flask when a stripping plate is not used, is mounted on an annular type of piston. This piston fits around the column of the jolt cylinder and inside the large cylinder at the bottom of the machine. Sheet-metal guards cover the pistons and cylinders, so that they are not visible in the illustration. For the 12-in. lift, the annular piston is provided with a bearing 18 in. long on the guiding column. The flask containing the sand can be lifted straight up from the pattern, so that only a very small amount of draft is necessary.

The lifting pins that engage the stripping plate or the flask are adjustable in position, so as to suit work of different sizes. The machine may be made with a hand-operated stripping device for use in connection with small jolt cylinders; also it may be provided with several stripping cylinders for long flasks.

## Sisson Portable Saw Bench for Patternmakers

A. C. Sisson, 41 Bayley St., Pawtucket, R. I., has placed on the market a small portable saw bench intended for the use of patternmakers and cabinet makers, and in jobbing machine shops where there is woodworking to be done. The machine is entirely self-contained. The arbor is belt driven from a motor mounted on a bracket at the side of the pedestal, the belt running inside the hollow column. The motor can be attached by a flexible cord to any convenient lamp socket.

The table is 38 in. from the floor, has a working surface of 16½ x 21½ in., and is provided with a rip fence that may be set at any angle for bevel sawing, as well as a cut-off slide that is also adjustable to obtain miters



SISSON PORTABLE SAW BENCH

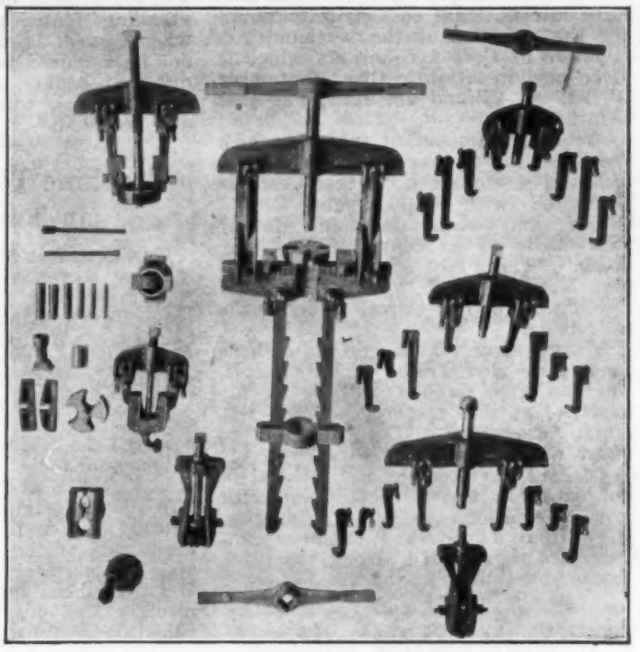
up to 45 deg. An adjustable stop attaches to the cut-off slide for duplicating lengths.

The arbor can carry a 6-in. saw, and it runs at 2,400 r.p.m. The table may be tilted to any angle or swung up out of the way entirely when changing saws. The machine weighs 184 lb. with the motor.

## Dover Combination Hand Press and Puller

A combination hand press and puller, designed primarily for use in garages and jobbing shops for the purpose of removing wheels, gears and bushings from their shafts and also for pressing such parts in place, has recently been placed on the market by Geo. W. Dover, Inc., Eddy St. and Thurbers Ave., Providence, R. I.

The base can be attached to the work bench by means of three lagscrews. With the yoke, spreaders and anvil



DOVER COMBINATION PRESS AND PULLER

plate in place, as may be seen in the center of the accompanying illustration, the device becomes an arbor press, for handling round pieces up to 18 in. in diameter.

Three yokes of different lengths are supplied, each having a set of hook arms to adapt the device for pulling off refractory wheels or for extracting bushings. The arms are reversible so that they may be used either side out, and they may be placed any distance apart within the limits of the yoke, to suit the work. Special hook arms are provided for removing gears and bushings from parts for certain makes of automobile that cannot be reached with the regular equipment.

The yokes, arms and other parts that are called upon to withstand stresses are drop forged from 40-point carbon steel, and are capable of sustaining a load of 50,000 lb. per square inch of sectional area. The illustration shows appliances adapted to use with the device.

## What Does Complication Mean?

BY A. W. BROWN

We are told to avoid complication; but if you were to ask me to define this term exactly, I would say very frankly that I could not. One machine is "complicated" because it contains a great number of parts; another, because although it has fewer parts, it has more kinds of parts.

On first thought, I might say that the latter was the more complicated of the two and the next day I might reverse my judgment. Take your choice; but in manufacture avoid unnecessary "complication" of either kind.

# News Section

## Accountants Will Hold International Conference

The preliminary program of the third international cost conference under the auspices of the National Association of Cost Accountants which is to be held in Atlantic City, September 23, 25, 26, 27 and 28, 1922, has just been issued.

Among the important subjects which are listed for discussion at the various technical sessions are "Actual Costs as Compared with Replacement Costs," "Sales and Administration Costs," "Standards as a Means of Reducing Costs," "The Place of Costs in Business Management," "Cost Problems of Specific Industries—Steel and Textile Industries."

It is expected that more than a thousand cost men from United States, England and Canada will be in attendance at this conference. The National Association of Cost Accountants under whose auspices the conference is to be held has become international in its operation through affiliation with cost associations in other countries. More than a thousand business concerns are represented among the three thousand members of the association.

## Interchangeable Mileage Bill Passed

The news of the passage of the Interchangeable Mileage bill recently by Congress will be received with no small degree of satisfaction by all persons who travel to any extent whatsoever. The amendment to the Interstate Commerce Act, providing for these books, reads, in part, as follows:

"The Commission is directed to require, after notice and hearing, each carrier by rail, subject to this Act, to issue at such offices as may be prescribed by the commission interchangeable mileage or scrip coupon tickets at just and reasonable rates, good for passenger carriage upon the passenger trains of all carriers by rail subject to this Act. The commission may in its discretion exempt from the provisions of this amendatory Act either in whole or in part any carrier where the particular circumstances shown to the commission shall justify such exemption to be made. Such tickets may be required to be issued in such denominations as the commission may prescribe. Before making any order requiring the issuance of any such tickets the commission shall make and publish such reasonable rules and regulations for their issuance and use as in its judgment the public interest demands; and especially it shall prescribe whether such tickets are transferable or nontransferable, and if the latter, what identification may be required; and especially, also to what baggage privileges the lawful holders of such tickets are entitled."

Now that constitutional authority has been given, it is expected and hoped that immediately following the signing of the bill by President Harding, the Interstate Commerce Commission will act without delay. One of the outstanding features of the new book, when issued, is that the traveler will not be required to carry a number of different books, inasmuch as the one form of book will be universally used and accepted.

## Machine Tool Exhibition in New Haven

On September 21 there will be opened in New Haven a machine tool exhibition under the joint auspices of the New Haven branch of the American Society of Mechanical Engineers and the Department of Mechanical Engineering of Yale University.

The Mason Laboratory of the University has been set apart for this purpose and the exhibition, devoted entirely to machine tools, will be held on September 21, 22 and 23.

While the original purpose of the exhibition was to bring before the manufacturers of the State of Connecticut and the engineering students of Yale University the latest developments in machine tool practice, it is also being held this year for the purpose of stimulating industrial activity and hastening a return to prosperous conditions in the machine tool industry.

No charge is being made for space and there will be no admission fee charged for spectators. H. R. Wescott, 207 Orange Street, New Haven, member of the executive committee of the New Haven Branch of the A.S.M.E. is chairman of the exhibition committee and any inquiry for information or space should be addressed to him.

## Department of Commerce Opens Atlanta Office

According to B. C. Gelsinger, director of the recently established Atlanta office of the Bureau of Foreign and Domestic Commerce, the only office of the bureau between Washington and New Orleans, the Atlanta district will embrace the five states of Georgia, Florida, Alabama and North and South Carolina. The office, which will be in room 205, Chamber of Commerce Building, Atlanta, will be ready to function on or about August 15.

Of recent years southern manufacturers have developed a large volume of export business with Latin-American countries, and this office is expected to bring about a further increase in this business. At present the principal products of export are machinery, machine tools and machinery supplies, common and face brick, lumber, and iron and steel products and railway equipment, most of the latter items from the Alabama district, and the principal trade is with Cuba, Mexico and Central America.

## Philadelphia Industrial Conditions

While there are many general rumors of substantially increasing business the increase in operations and employment in the metal manufacturing industry of Philadelphia during June, though steady, has been but slight, as revealed by the compilation, embracing the reports of 132 metal manufacturing establishments in this vicinity.

According to statistics just compiled by the Metal Manufacturers' Association of that city, 132 shops added 1,313 employees to their payroll during the month of June equivalent to an increase of 8 per cent compared with May. The labor turn-over, while somewhat less than in May, is high, 6,080 hands being put to work to obtain a net increase of 1,313 employees.

The increase in June as compared with May was well divided among all of the varied groups of the industry with the exception of group 1, including shipyards and marine engine plants; group 4, including knitting, weaving, dyeing and drying plants; group 8, including metal stamping works; and group 10, including electrical, surgical and dental specialties and instrument factories.

Average weekly operating hours remained about the same and are slightly more than the average weekly operating hours in July, 1920. No further decreases in wages were made and the average reduction since the depression set in two years ago totals 22.4 per cent which figure is likely to be maintained some little time.

Fewer plants had an increase in weekly man-hours in June than in May and the aggregate increase is very considerably less than it was in the preceding month. This may indicate that the rising tide of business in our lines has temporarily reached its peak and may subside. Similar indications might be drawn from the decreasing demand for labor as revealed by the classified want advertisements in the leading newspapers of this city, which this month have averaged 20 per cent less for male help and 35 per cent less for female help, the male help demand having declined even in the face of large advertisements for labor to take the place of men on strike from the railroad shops.

An examination of starting and prevailing rates for labor in eighty-three metal working establishments now employing 27,059 hands, reveals that there has been only very slight changes in rates since February of this year. The rates for some crafts are slightly higher and for others slightly less. Generally speaking, however, there has been no change of moment and the averages are practically the same as prevailed in February. Unless there is some considerable improvement in business conditions now prevailing it is probable, in our opinion, that the rates now existing will be maintained for quite some time.

## Machinery Manufacturer Returns from Trip to Orient

Mr. Henry Harnischfeger, President of the Pawling & Harnischfeger Co. at Milwaukee, Wis., has just returned from a six months' tour around the world, in which he visited Japan, China, the Philippine Islands, India, and several European countries in an investigation of business conditions and possibilities generally, but more particularly in the Far East.

He found those countries suffering from the effects of the world-wide business depression, because of a large surplus stock of materials of all kinds left over from the war days. These, he says, must be used up before new supplies will be needed. Contrary to the general opinion there is a growing market in the Far East for labor-saving machinery of all kinds. This is due to the fact that labor conditions are slowly reaching a point where costs of construction and manufacture are high. Furthermore, in spite of the fact that labor is cheap and so inefficient the labor costs on projects cannot be figured much lower than in this country.

In the steel-making line there is considerable activity as well as in large civil engineering projects, such as power plants, drainage, irrigation and building construction.

The opportunities in Burma for flood control, were especially impressive. They have a problem with the flood disasters on the Irrawaddy River such as we have on our own Mississippi where they are constantly building up embankments to keep the river within its channel. For this reason there is a large market for gasoline-driven excavating equipment. It will be necessary, however, on account of the intense heat, to design gas engines especially to withstand the high heats found in that country. On large railroad projects, particularly, the use of gasoline-driven excavators has been recognized as economical.

In the interior of India there is a large amount of construction work to be done but up to this time it has been particularly hazardous due to the loss of life among workmen, because of wild beasts and reptiles. It is believed that this work can be done very much more safely with the use of machinery.

Of interest to Americans is the attitude of the natives. The Indian people are very well disposed toward American-made goods. They feel that owing to the vastness of their own country and also of ours that we have had problems which are very similar to their own and for this reason they believe that the machinery which Americans designed for the construction of the Erie Canal, Panama Canal, Mississippi flood control and other projects will meet their conditions. This experience which United States manufacturers have had has not been shared by European manufacturers since they have never had to contend with these propositions on such a large scale. There are only two great differences between the conditions in India and United States, first, the different class of labor which they have in India and, secondly, weather and climatic conditions.

Another feature, according to Mr. Harnischfeger, which must be taken into account in the design of equipment for use in these countries is the fact that their bridge capacities and clearances are much less than ours and for this reason, for the present, at least, mobile equipment must be built in such a manner as to permit of its being easily dismantled.

Altogether, Mr. Harnischfeger was much impressed by the possibilities of the Far East and he believes that there is a good market there for labor-saving machinery of all kinds.

## Business Is Better in Ohio

By A Field Editor

In spite of coal and railroad strikes, there is a decidedly better tone to business in Ohio and surrounding districts. Not that the strikes have not had their effect, for both trains and interurbans are delayed and it isn't safe to bank on scheduled connections. But there isn't a shop I've visited so far that hasn't greeted me with a happier look than I've seen for the past year. Some haven't really got back into their stride, their organization hasn't been completely rebuilt even with essential men, but they are on the way and business is coming in very satisfactorily.

Direct business is very evident in automobile accessories such as jacks, in household appliances and other lines. This is reflecting itself in the machine tool shops and in the shops building special machinery as well. New products are being developed, such as large milk cans on the vacuum bottle principle, all of which means shearing and punching machines for the sheets, drawing machines for the caps, and welding machines for putting them together.

New types of battery boxes are being molded of non-conducting material to replace the dove tailed wooden box for an outer case. This means large presses for forcing the materials into the molds and again gets back directly or indirectly to the machine tool field.

Then too there is a district movement toward the use of metal, of the duralumin order in airplane construction. One large and well known builder is doing some very interesting work in this line. And even though this may not seem to affect the machine tool business materially at present, it is a step toward it, and one which may eventually amount to quite a volume of business.

Business is decidedly better. Orders are filtering in from unexpected places and the man who still pulls a long face over the outlook should consult a specialist and have his "pessimisticas" removed at once.

## New England N. A. S. E. Elects Officers

At the convention of the New England branch of the National Association of Stationary Engineers in Springfield, Mass., July 12 to 15, the city of Hartford was awarded the prize for making the largest gain in membership. Of 38 stationary engineers' organizations in the New England field, 27 are represented in the association. Special emphasis was laid on the progress of the work of the educational committee, by means of examinations, lectures, motion picture films, etc. These officers were elected for the ensuing year: president, James H. Henderson, Lynn; Vice-president, Edwin H. Perry, Worcester; secretary, Freeman L. Tyler, Taunton; treasurer, Walter H. Damon, Springfield.

The New England Association of Commercial Engineers, meeting at the same time, elected Henry H. Lynch, Boston, president; Charles S. Ceilley, New York, vice-president, and Maj. J. W. H. Myrick, Boston, treasurer.

## Reports on Three-Shift Day to Be Discussed by Engineers

Findings in a nationwide survey of the three-shift day in American industry will be placed before the Executive Board of the American Engineering Council of the Federated American Engineering Societies, at a meeting of the Board to be held in Boston on September 8 and 9, it was announced following a meeting of the committee on procedure in New York.

Two reports, dealing with exhaustive investigations of the two-shift and the three-shift day problems in numerous industries will be presnted. One, prepared by Horace B. Drury, formerly of the faculty of Ohio State University, will describe the extent of two-shift operations in the continuous industries as well as the procedure followed and the results noted by those companies which have changed from the two-shift day of twelve hours each to the three-shift day of eight hours each.

Among the industries investigated are the metals, glass and cement, lime, brick, and pottery, chemicals, sugar, salt, petroleum, cottonseed and other vegetable oils, paper, flour, rubber, miscellaneous manufactures, and mines, electricity, gas, water, and ice, transportation, communication, care-taking, and personal service.

A second report on an investigation of the *modus operandi* involved in changing the operations of a steel plant from a two-shift to three-shift methods will be made by Bradley Stoughton, former secretary of the American Institute of Mining and Metallurgical Engineers. Both investigations are being directed by the American Engineering Council's Committee on Work Periods in Continuous Operation Industries, of which H. E. Howe of Washington, president of the American Chemical Society, is chairman.

The findings of the committee, which are expected to be a notable contribution to the facts of present day industry, will be presented to the Boston meeting of the engineering board, composed of leading engineers from all parts of the country, for definite action. A preliminary report by Mr. Drury estimates that "very roughly, the number of shift workers in the United States is probably well over 500,000, though likely not as large as 1,000,000." Industries of the South and the Far West are included in the survey as well as the industries of the East and Middle West.

The number of men on twelve-hour shifts in the period preceding the industrial depression was given as "perhaps not far from 300,000, of which about as many were outside the steel industry as within it."

# The Business Barometer

## This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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SETTLEMENT of the railway strike is deferred pending an adjustment of the seniority question. Without debating the merits of the issue, which are not entirely clear, it may be said that the majority of the public realize that life is but a series of compromises and believe that the railroad executives and the shop men will soon get together.

The coal strike is different. It promises to be a long drawn out fight the cost of which will be largely borne by consumers who will have to pay exorbitant prices for their winter coal. Mr. Hoover is promising that no one will suffer but it does not appear that he or any one else will be able to control prices. Some cynics are meantime asserting that the coal operators are not averse to a continuance of the strike until frost because they will then be able to claim that they had to yield to the men or let the people freeze and so justify the prices to which coal is already mounting in some localities. Much of the profit of this advance, however, is undoubtedly being reaped by speculators.

Facing these possibilities the stock market is a little less confident in tone, though it is still plain that if the strikes were settled the prevailing optimism would speedily express itself in speculative activity and the continued firmness of the railroad stocks reflects the improvement in earnings shown and expected.

The bond market, though less active, is also firm because money is cheap and bankers can get better returns by buying good securities on a 5 per cent basis than they can by buying commercial paper at 4 per cent.

The supply of good commercial paper is, moreover, limited by the indisposition of merchants to increase their stocks of goods while the strikes are unsettled. The weekly statement of the Federal Reserve System shows a reserve ratio of 79.6 per cent as compared with 79.2 a week previous. The gold held has increased by $17,000,000. These figures assure an abundance of bank credit for the balance of the year.

The foreign news is less encouraging. German marks sold in New York at 11⅛ cents a hundred last Wednesday. Their international value is therefore negligible. The decline is attributed to the Balfour note intimating that Great Britain cannot forgive the debts due her by her late companions in arms or her share in the German reparations unless she receives some compensating consideration. In this note the hope of "writing off through one great transaction the whole body of interallied indebtedness" is somewhat despairingly suggested. The suggestion is apparently intended for American ears, but as there seems no likelihood it will be heeded here it remains to be seen what effect it will have upon France with whose premier Poincaire Lloyd George is to confer on August 7th.

If this conference shall not lead the French to make concessions that will justify a loan to Germany continental Europe will find itself in a distressing predicament for an economic debacle that will destroy the productive and purchasing power of the Germans must adversely affect all of their neighbors. The very gravity of the crisis that threatens is my main reason for believing that it will be averted. If it is averted the mark will advance as sensationally as it has declined.

The steel industry is commencing to feel the coal shortage acutely. The demand is good but the mills cannot operate without fuel and the result is more or less paralysis all along the line. One can only hope, but it must be admitted that more or less stagnation and unemployment in the Pittsburgh and Youngstown districts are probable unless coal is soon to be had in increased quantity and at reasonable prices.

Copper is again firmer, but the demand has not yet lifted the price above 14 cents nor is it likely that it will if the steel mills continue idle.

Cotton had a convulsion upon the publication of a Government report which no one understands and but few believe. The advance of nearly two cents a pound proved ephemeral and most of it has been lost. The best trade opinion is that the crop outlook is better but current estimates of the yield are not yet in excess of the expected demand.

But European requirements will be reduced unless the financial collapse of Germany can be averted and it is probable that economic conditions abroad will soon outweigh crop reports as a market influence.

Raw sugar continues to hang around four cents ex duty, with refined selling at the classic price of seven cents or 7 pounds for 50 cents. The statistical strength of sugar is generally recognized and emphasized. It remains to be seen whether it has been discounted. In any event the scarcity predicted cannot be acutely felt for some time yet.

The grain markets are quiet without much change. I had thought that the present price of wheat meant possible loss and distress to the farmers who raised it, but since they do not seem to be complaining I am disposed to think that I was wrong. Perhaps the relatively high prices at which corn and hogs are selling partially offset the low price of wheat. At all events business in the Middle West seems to be good and a fair trade is generally reported.

The dry goods and jobbing trade is still reasonably active though a seasonal August dullness is commencing to be noticeable. Here again it is necessary to take the coal strike into consideration in considering the future. If people have to pay $20 a ton for coal they will buy less clothing.

Wool and woolen goods are somewhat reactionary as a result of sheer weariness over the interminable tariff debate. Most woolen dealers and manufacturers are now praying that Congress will adjourn without passing a tariff bill, but Mr. Lodge has issued a ukase to the contrary and there is not much hope that these prayers will be granted.

In the automobile industry several of the more important producers have reduced prices and there is some talk of a price cutting war which only the fittest will survive. I doubt if this is warranted but the automobile selling season is about over and it is quite natural that the manufacturers should want to clean up the year's output before commencing on their next year's program.

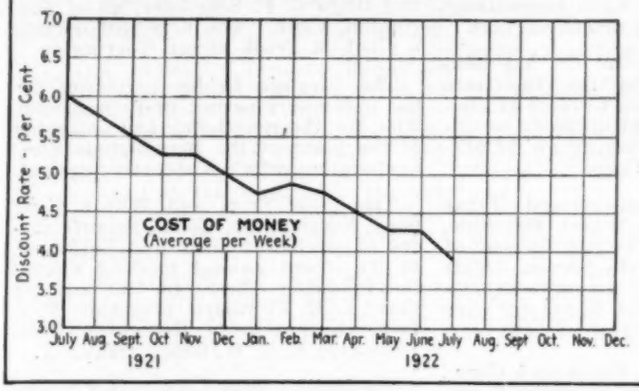
Viewing the outlook broadly and inclusively confidence and optimism appear to be warranted provided the President or some one else can find a way to settle the coal and railway strikes. I am, however, impelled to admit that impatience and irritation over their continuance are now commencing to be noticeable and it is questionable whether the serene and surprising stolidity upon which I have so often commented will persist if the American people have to face a blockade in transportation and a winter in which coal will be scarce and prohibitively high.

That I may get a short holiday and acquaint myself with the feeling of business men throughout the country I shall shortly leave New York for a trip to the Pacific Coast. I go by the Northern route and shall return through Texas and the South. As I travel my impressions will be telegraphed to New York for inclusion in these weekly letters.

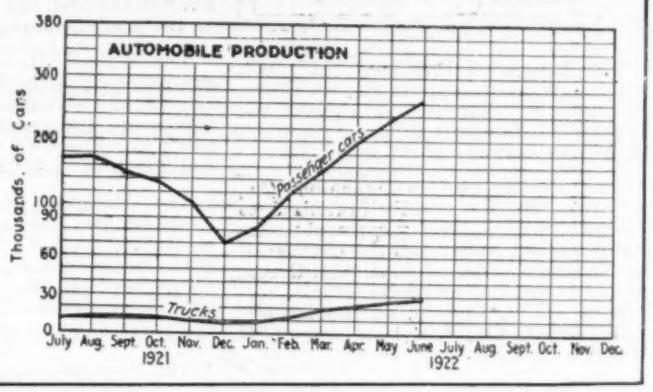
## Machinery Companies Consolidate

Officials of the Mackintosh-Hemphill Co., according to information received from Pittsburgh, have confirmed reports that the Pittsburgh Steel Foundries Co. and the A. Garrison Foundry Co., Pittsburgh, and the Woodward Machine Co., Wooster, Ohio, have been merged with the Mackintosh-Hemphill Co. with a capital of $10,000,000. The combination will manufacture rolling mill machinery and will employ 1,500 men. No further plant extension will be made at this time, but the company has purchased forty-five acres in the vicinity of Pittsburgh to provide for future needs.

**Average weekly rates for 60 and 90 day commercial paper based on New York quotations.**




**Passenger cars and trucks, production based on figures compiled by the Bureau of Foreign and Domestic Commerce.**




**RAILROAD earnings for June** from reports of 170 roads, recently available, show an aggregate gross revenue of $435,825,442, an increase of 2.4 per cent over the corresponding month a year ago. Net earnings on these same roads totaled $70,601,448 as against $47,979,901, an increase of 47.1 per cent. With these figures as a basis, the June net for all railroads in the United States will probably amount to $76,000,000, approximately 4½ per cent return on the property valuation.

**Commercial failures in the United States** during July, according to preliminary returns to R. G. Dunn & Co. totaled 1743 with liabilities of $36,900,000. Failures in the month previous totaled 1,740 with indebtedness amounting to $38,200,000. In July of last year there were 1,444 insolvencies.

**Contracts awarded for the construction of industrial** works in the United States and Canada during the month of July had a total value of $11,616,000 as compared with the high point reached in June, the contract awards in that month totaling $24,560,000. The grand total value of contracts awarded during the month of all classes of construction, including industrial works, reached $119,173,906.

**Corporate financing during July** continued heavy, although below the exceptionally high mark reached in June. Bonds, notes and stocks issued by railroads, industrial enterprises and public utilities during the month totaled $241,438,380 as compared with June financing totaling $354,355,940. In the corresponding month of last year new financial issues amounted to $128,352,360. Industrials led in July with a total of $117,402,780.

## Comparative Prices of Shop Supplies

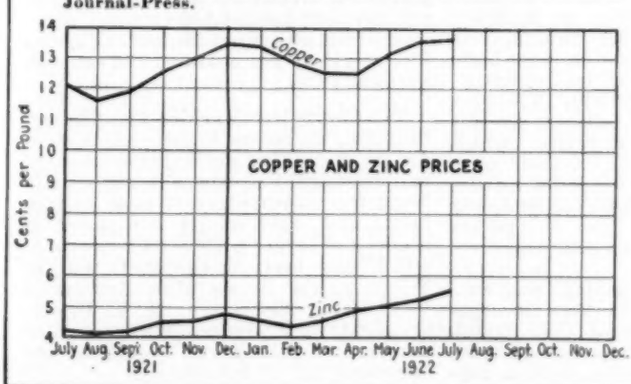
Average of New York, Chicago and Cleveland Prices

| | Unit | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|---|
| Soft steel bars | per lb. | $0.026 | $0.0252 | $0.0278 |
| Cold finished shafting | per lb. | 0.0335 | 0.0335 | 0.0428 |
| Brass rods | per lb. | 0.165 | 0.1550 | 0.159 |
| Solder (½ and ½) | per lb. | 0.22 | 0.213 | 0.18 |
| Cotton waste | per lb. | 0.11 | 0.11 | 0.122 |
| Washers, cast iron (½ in.) | per 100 lb. | 3.83 | 3.83 | 4.06 |
| Emery, disks, cloth, No. 1, 6 in. dia. | per 100 | 3.11 | 3.11 | ..... |
| Lard cutting oil | per gal. | 0.575 | 0.575 | ..... |
| Machine oil | per gal. | 0.36 | 0.36 | ..... |
| Belting, leather, medium | off list | 40–5% @50% | 40–5% @50% | |
| Machine bolts up to 1 x 30 in. | off list | 55% @60% | 50%@ 65–10% | 50%@ 60–10% |

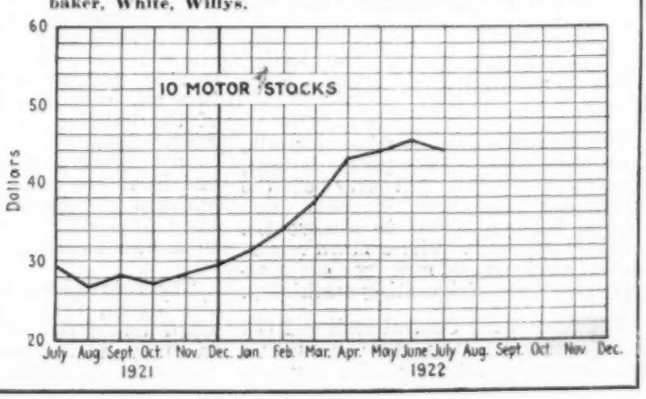
**Freight cars loaded with revenue freight** on 201 railroads of Class 1, for the week ending July 22, with the exception of coal, reached the highest point in the history of American roads. A total of 861,124 cars were loaded as compared with 860,907 in the week previous, and 788,034 in 1921.

**Skilled machine operators are scarce,** reports from certain centers indicating that the demand for experienced hands exceeds the supply. Philadelphia is paying from 50 to 85 cents to tool makers; from 40 to 80 cents to bench hands and from 45 to 85 cents to lathe hands. In Detroit, where the demand for good operators is strong, tool makers and lathe operators are being paid from 75 to 80 cents. Chicago is paying from 60 to 70 cents for lathe operators and bench hands and from 80 to 90 cents for skilled tool makers. In the Cleveland and Cincinnati districts the range on tool makers is between 50 and 75 cents; bench hands, between 40 and 60 cents and lathe hands between 40 and 55 cents. Pattern makers in Cleveland are receiving from 65 cents to $1.00. In the New York district 75 cents is the prevailing rate for tool makers with bench and lathe hands receiving from 50 to 60 cents per hour.

**Average of New York weekly quotations on electrolytic copper and zinc as reported by Engineering and Mining Journal-Press.**




**Average price of ten automotive stocks: Chandler, General Motors, Hupp, Mack, Pierce, Stewart, Stromberg, Studebaker, White, Willys.**



# Business Items

The Associated Engineers, Inc., Milwaukee, Wis., through its vice-president, William E. Skinner, announces the removal of its offices to larger quarters at 373 Broadway, Milwaukee.

The Chapin-Skelton Machine Co., Syracuse, N. Y., recently organized to manufacture the Triplex garment pressing machines, announces the election of the following officers: Orville H. Green, president, and Clifford H. Gearle, secretary. E. I. Chapin, of the Brown-Lipe-Chapin Co., has been appointed factory manager.

The Colorado Fuel and Iron Co., for the second quarter of the current year reports net earnings of $1,012,094 as compared with the first quarter earnings of $596,243. Earnings in the second quarter of 1921 amounted to $682,490.

The Fox Furnace Co., Elyria, Ohio, manufacturers of Sunbeam furnaces, will open a Southeastern office and warehouse in Atlanta in the near future. L. F. McDonald will be district manager and states that a force of salesmen will cover the territory.

The Cushman Chuck Co., chuck manufacturers, Hartford, Conn., has recently established a branch office and distribution store, at 130 High Street, Boston, where it will be better fitted to handle the trade in that section.

The Pennsylvania System, for the month of June, reports a net operating income of $6,637,649, an increase of $1,408,893 over the previous month. The net operating income for the first half of this current year, amounting to $44,442,202, represents an increase of $34,788,204.

The Central Coal and Iron Co., Holt, Ala., it is reported, will resume operations at its furnace at that point early in August, bringing all departments of the company up to full capacity as is now the case at the company's pipe plants at Bessemer and Anniston.

The General Motors Co. for the six months ending June 30, 1922, reports net profits of $30,711,238 and a surplus of $27,403,428, after deducting charges, federal taxes and preferred dividends, which is equivalent to $1.33 per share on the common stock.

The Pugh Bottle Co., Toledo, Ohio, has been incorporated with a capital of $200,000 to manufacture and sell various kinds of bottles. The incorporators are David Pugh, Charles Guernsey, Elmer C. Wieke, Frank R. Smith and Mildred L. Hova, all of Toledo.

The Norwalk Iron Works, Norwalk, Conn., has absorbed the plant, designs, patents and other property of the Automatic Carbonic Machine Co., Peoria, Ill., and plans to remove the plant to Norwalk. The concern manufactures oxygen and hydrogen compressors, etc., and refrigerating machinery.

The New York Central Railroad Co. in its report for June, shows gross and net earnings greater than for any previous month of the current year. The gross amounted to $29,462,408 and the net to $6,008,492 as compared with $27,868,173 and $5,517,555 respectively, in the corresponding month of 1921.

The Wabash Railroad Co. has been granted authority by the Interstate Commerce Commission to issue $4,245,000 worth of equipment trust certificates to be used in paying for $6,305,800 worth of freight cars.

The Missouri, Kansas and Texas Railroad Co., in its report for June, shows an increase in net income of $518,149 over the month previous. This brings the half yearly net up to $5,556,096, or an increase of $2,814,922 over the corresponding period of last year.

The Porcupine Co., Bridgeport, Conn., with a large plant in Fairfield, Conn., manufacturers of boilers, and fabricators of structural steel, has recently filed a certificate with the Secretary of Connecticut, to increase its capital stock from $150,000 to $250,000, the proceeds to be used for expansion of the company's business.

The Baltimore and Ohio Railroad Co. has filed an application with the Interstate Commerce Commission for authority to issue $6,750,000 of certificates in aid of acquisition of freight and passenger equipment, the total cost of which will be $9,069,650.

The Reduction Sales Co., manufacturers of equipment for the oxyacetylene welding and cutting industry, it is reported, will permanently locate a plant in Birmingham, Ala., having obtained a site there for the purpose. The initial investment will be about $250,000.

The New England Brass Mfg. Co., Danbury, Conn., has recently been incorporated under the laws of Connecticut, to operate the brass goods manufacturing business now conducted at the plant on Maple Street, that city, by the firm of the same name. The capital stock is $22,000, and the incorporators are: Frank Peon, Mohammed Inamruddin and M. E. Krebbs, all of Danbury.

The Rome Stove and Range Co., Rome, Ga., has completed its new plant there and started operations. The old plant, known as the Bowie Stove Works, was destroyed by fire several months ago, the company then reorganizing under the present name and rebuilding the plant.

The Bridgeport, Conn., Chamber of Commerce is having preliminary plans drawn up for the erection of an incubator industrial building on Railroad Ave., Bridgeport. The building, as planned, will be five stories high, 60 x 280 feet, of modern mill construction, and will cost $250,000. The idea of the building is to allot space for small industrial enterprises which cannot afford a factory of their own, and in this way help to build up the business of the companies, enabling them at some future time to operate their own building.

The Schroeder Bros. Mfg. Co., Inc., Torrington, Conn., has been incorporated under the laws of Connecticut, to engage in the manufacture of tools, hardware specialties, etc., with a capital stock of $100,000. The incorporators are: Gustave A. Schroeder, Arthur E. R. Schroeder, Ernest E. Schroeder and Hugo C. F. Schroeder, all of Torrington, Conn. The firm will operate a plant on Brook Street, Torrington.

The Virginia Bridge and Iron Co. has obtained a permit in Birmingham, Ala., for the remodeling and enlarging of the plant of the Birmingham Steel Corporation, which is recently acquired.

The Peck, Stow and Wilcox Company, Southington, Conn., manufacturers of mechanics tools and hardware, at its recent annual meeting elected the following officers for the ensuing year: L. E. Fichthorn, president; T. J. Ray, vice-president; George S. Case, secretary; E. N. Walkeley, treasurer.

The Mullins Body Corporation for the first half of 1922 reports gross sales of $1,070,875 and gross profits from sales of $121,038. Net income after expenses and other charges amounted to $35,006. The profit and loss surplus on June 30 before dividends amounted to $1,976,141.

The Minneapolis, St. Paul & Sault Ste. Marie Railway Co. for June reports operating revenues of $4,204,331, an increase of $923,173 and net operating income $844,525, an increase of $1,023,459. For six months ended June 30 operating revenues were $19,254,928, an increase of $12,814 and net operating income $510,322, an increase of $3,396,924.

The C. A. Spotz Co., Inc., Stamford, Conn., has been incorporated under the laws of Connecticut, to make and deal in machinery and mechanical devices, etc. The company has a capital stock of $50,000, and the incorporators are: Chester A. Spotz, Greenwich, Conn.; Carleton Pratt, 50 West 72nd St., New York; Gustavius Pratt, 151 Fifth Ave., New York; Harry M. Rice, 100 Broadway, New York; Gustave Bergmark, Henry G. Bauman, William H. Specht and O. A. Helmer, all of New York City. A meeting will be held shortly and officers will be chosen.

The Fisk Rubber Co. has issued its report for the six months ended June 30, showing a net income of $1,111,191, which, after deduction of allowance of dividends on the first and second preferred stocks, is equal to about 50 cents per share on the common stock of no par value.

The St. Louis Southwestern Railway Co. for the year ended Dec. 31, 1921, reports a net income of $2,493,481, which, after allowing for 5 per cent preferred dividends, is equal to $9.16 per share on $16,356,100 common stock, comparing with a net income of $2,959,836, or $12.01 per share on the common stock in 1920.

The Cherrytree Machine Co., Cherrytree, Pa., according to reports, is moving its machinery and other equipment to Johnstown, Pa., where it will shortly begin the manufacture of mine pumps, hoists and other mining equipment in a new and larger plant. The company, which has been reorganized, will be known as the Brown Mine Equipment Co. and its officers are: H. V. Brown, president; H. J. Meehan, vice-president; and John C. Cosgrove, secretary and treasurer, all of Johnstown.

# Personals

A. M. LINDSLEY, formerly connected with the Cincinnati Milling Machine Co., and at the present time chief engineer of the Alvord Reamer and Tool Co., Millersburg, Pa., has been placed in complete charge of the advertising department of that company. He will continue his duties as chief engineer, co-ordinating the work of the two departments.

A. P. ALDRICH, JR., who, with his brother, Robert Aldrich, has for some time operated the Aldrich Machine Works at Greenwood, S. C., specializing in textile machinery work, has accepted a position as specialty engineer with the Saco-Lowell Shops, and has located permanently in Boston. He will have charge of the adoption of ball bearings to the various types of textile machinery manufactured by the Saco-Lowell Shops, a line of work in which Mr. Aldrich is recognized as an expert.

G. A. NORTON, formerly associated with the Utility Trailer Manufacturing Co., has been elected treasurer and engineer of the Hercules Trailer Manufacturing Co., Los Angeles, Cal.

COL. ELMER H. HAVENS, who was president and co-receiver of the old Locomobile Company of Americe, Bridgeport, Conn., has been made vice-president and general manager of the new Locomobile Corp. of America, the new company formed by W. C. Durant, who recently purchased the Locomobile plants in Bridgeport.

J. DUNCAN UPHAM, treasurer of the Sullivan Machinery Co., Claremont, N. H., was elected a director of the Boston and Maine Railroad Co., at the recent annual meeting held in Boston.

CHESTER A. JEWETT, Fletcher Savings and Trust Building, Indianapolis, has been named receiver for the Handi Tool Manufacturing Co., of that city.

WILLIAM D. WOOLSON, treasurer of the Jones & Lamson Machine Co., manufacturers of lathes, etc., Springfield, Vt., was elected a director of the Boston and Maine Railroad, at the meeting held in Boston July 27.

CHARLES H. MASON, formerly associated with the Utility Trailer Manufacturing Co., has been elected president and manager of the Hercules Trailer Manufacturing Co., Los Angeles, Cal.

E. KENT HUBBARD, Middletown, Conn., president of the Manufacturers' Association of Connecticut, is a member of the recently appointed fuel administration commission of Connecticut, made by Governor Everett J. Lake, to have charge of the distribution of coal in the state.

LAWRENCE G. PRITZ, formerly general superintendent of the Canton plant of the Timken Roller Bearing Co. has been named by the Sizer Steel Co., Syracuse and Buffalo, to take charge of production at its plants in those two cities.

R. W. MCLAREN, for the past twenty-five years connected with the Brown & Sharpe Manufacturing Co., has joined the S. W. Card Manufacturing Co., division of the Union Twist Drill Co., Mansfield, Mass., and will act in the capacity of special sales representative.

W. T. JOHNSTON, for the past six years a member of the sales force of the Greenfield Tap & Die Corporation, has joined the S. W. Card Manufacturing Co. division of the Union Twist Drill Co., Mansfield, Mass., to represent that company in Western territory.

# Export Opportunities

**The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.**

An agency is desired by a firm in Italy for the sale of machinery and electrical apparatus. Correspondence, Italian, French, or Spanish. Reference No. 3061.

The purchase of tools and machinery is desired by a mercantile firm in Czechoslovakia. Quotations, c. i. f. German, French, or Holland ports. Reference No. 3054.

A builder and contractor in Northern Chile wishes to purchase machinery for installing a carpenter shop. Quotations, c. i. f. Chilean port. Correspondence, Spanish. Reference No. 3044.

A manufacturer in England desires to purchase automatic, rapid-working stamping machines for stamping medallions and similar articles. Quotations, f.o.b. American port. Payment, cash. Reference No. 2023.

A manufacturing company in South Africa desires to purchase machinery for making red oxide paint, pug mills, mixers, grinders in oil, etc. Catalogues should be forwarded. Reference No. 3047.

A firm of importers in China is desirous of being placed in touch with manufacturers of machinery, electrical apparatus and supplies, mechanical supplies, sundries, etc., who are not already represented in that country. Reference No. 3041.

An agency is desired by a merchant in Italy for the sale of files, locks, wrenches, nails, screws, drills, and tools in general. Quotations, c. i. f. Western Italian ports. Correspondence, Italian or French. Reference No. 3039.

A mercantile firm in Czechoslovakia desires to purchase tools and implements, and also household articles which may be sold by a hardware dealer. Quotations, c. i. f. German, French, or Holland ports. Correspondence, Czech or German. Reference No. 3046.

A mercantile firm in Italy desires to purchase and secure an agency for the sale of metal-working machines, files and twist drills, electric dynamos, machinery belting, tools, and mechanical appliances in general. Quotations, c. i. f. Leghorn or Genoa. Reference No. 3004.

A manufacturer in Mexico desires to purchase a machine for extracting oil from castor beans, of a capacity of 2,540 pounds of beans per day of 10 hours. Quotations, f. o. b. New York. Terms, cash with order. Correspondence, Spanish. Reference No. 3038.

A government official in Palestine desires to purchase a cement gun, and receive technical information, such as catalogues and trade journals, on water supply, hydro-electric power, and kindred public utilities. Quotations, c. i. f. Jaffa. Reference No. 3057.

A mercantile company in the Baltic Provinces desires to purchase and secure an agency for agricultural machines and implements, wood-working machinery, and especially threshing machines, 36 to 48 inch and 22 to 34 inch; steam tractors of 8 horsepower; portable steam engines of 3 to 5 horsepower; emery grindstones for sharpening saws and other instruments; and Diston circular and hand saws; and also kitchen utensils. Quotations, c. i. f. Baltic port. Correspondence, German, Russian, or Lettish. Reference No. 3058.

# Trade Catalogs

**Motor Starters.** The Monitor Controller Co., Baltimore, Md. A special folder on the company's thermaload starter for single and polyphase motors with illustrations showing construction and assembly.

**Cork Insulation.** The Armstrong Cork and Insulation Co., Pittsburgh, Pa. A folder entitled "A Neglected Source of Economy." This new publication deals with the saving which can be effected in manufacturing plants by the use of refrigerated drinking water systems.

**Gears.** The Van Dorn & Dutton Co., Cleveland, Ohio. A special publication entitled "Bringing the Van Dorn Plant Home to You." The booklet contains interior views of the Van Dorn plant and is intended to acquaint the user with the company's industrial gear products of various kinds.

**Lead Welding.** The Bastian-Blessing Co., 125 West Austin Ave., Chicago, Ill. A special folder entitled "Sparks" and known as leaflet No. 2. The leaflet has been prepared to satisfy the demand for information on the subject of lead welding on battery service outfits. Illustrations are shown of two styles of lead welding outfits.

**Electric Dynamometers.** The Sprague Electric Works, of the General Electric Co., New York City. A special bulletin No. 48718. The bulletin features the Sprague electric dynamometer chassis test system for car manufacturers, service stations and public garages. Numerous illustrations are given showing characteristic installations on test floors of various motor car manufacturers with detailed information as to the operation of the system.

**Small Tools.** The Alvord Reamer and Tool Co., Millersburg, Pa. A new general catalog, known as catalog No. 6, containing 243 pages. The publication lists the company's complete line of reamers, drills, milling cutters, taps and dies. Special emphasis has been placed upon their high power milling cutters in all styles and types, both of standard and special design. The catalog contains a special section devoted to tables and other useful information conveniently arranged. Besides the general index, it has been arranged with a thumb-index on the edges for ready reference to the various sections of the book.

**Elevating trucks, stackers and trailers.** The Lewis-Shepard Co., 566 East First Street, Boston, Mass. A general catalog of thirty-two pages conveniently arranged and bound for filing in vertical filing cabinet. The catalog is replete with illustrations showing the various labor-saving specialties made by this company in actual operation in numerous plants. Jacklift elevating trucks, singlelift elevating trucks, wood and metal leg platforms, self-loading barrel and case trucks, the Lewis-Shepard stacker and trailers for electric trucks are all featured in special sections with details given as to their construction and mode of operation. A price list and part list accompanies the catalog, in the arrangement of which considerable care has been taken.

# Forthcoming Meetings

**Association of Iron and Steel Electrical Engineers.** Annual convention, Sept. 11 to 15 at the new auditorium, Cleveland, Ohio. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

**American Institute of Mining and Metallurgical Engineers**, annual convention, Sept. 25 to 28, 1922, San Francisco, Cal. Secretary, F. F. Sharpless, 29 West 39th Street, New York City.

**American Society for Steel Treating.** Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4600 Prospect Ave., Cleveland, is secretary.

**American Gear Manufacturers' Association.** Fall meeting, Chicago, Ill., October 9, 10 and 11, 1922.

**American Manufacturers Export Association** annual convention. New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

**National Machine Tool Builders' Association,** annual convention. New York City, October, 1922. Secretary, E. F. Du Brul, 817 Provident Bank Building, Cincinnati, Ohio.

**National Founders Association.** Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

# The Weekly Price Guide

### Rise and Fall of the Market

**Advances**—Bulk of business in steel shapes, plates and bars quoted at $1.80@$1.90 per 100 lb., f.o.b. Pittsburgh. Quotations of $1.70, however, made for large tonnages on contracts with regular customers. New inquiries for small tonnages quoted as high as $2 per 100 lb.

Advances in pig iron and mill price of bar iron reflected in higher quotations on machinery castings in Cincinnati; other cities showing upward tendencies. Demand for lead increasing; prices higher in St. Louis. Shortage of zinc; prices up ¼c. per lb. in New York warehouses and slightly higher in St. Louis. Copper market firmer. Discounts reduced on heavy leather belting, following advance in hides.

**Declines**—Tin quoted in New York warehouses at 32¾c. as against 33¾c. per lb. Raw linseed oil, 89c. as compared with 91c. per gal. (5 bbl. lots) on keew ago.

## IRON AND STEEL

**PIG IRON** — Per gross ton — Quotations compiled by The Matthew Addy Co.:

| | |
|---|---|
| CINCINNATI | |
| No. 2 Southern | $24.56 |
| Northern Basic | 27.27 |
| Southern Ohio No. 2 | 27.27 |
| NEW YORK—Tidewater Delivery | |
| Southern No. 2 (silicon 2.25@2.75) | 30.66 |
| BIRMINGHAM | |
| No. 2 Foundry | 20.50 |
| PHILADELPHIA | |
| Eastern Pa., No. 2x (silicon 2.25@2.75) | 29.76 |
| Virginia No. 2 | 30.17 |
| Basic | 27.25 |
| Grey Forge | 27.25 |
| CHICAGO | |
| No. 2 Foundry local | 24.50 |
| No. 2 Foundry, Southern (silicon 2.25@2.75) | 26.00 |
| PITTSBURGH, including freight charge from Valley | |
| No. 2 Foundry | 25.00 |
| Basic | 25.00 |
| Bessemer | 25.00 |

**IRON MACHINERY CASTINGS**—In cents per pound:

| | Light | Medium | Heavy |
|---|---|---|---|
| Cincinnati | 15.0 | 10.0 | 4.75 |
| Detroit | 1 @12 | 8.0 | 3@4 |
| New York | 9@10 | 6.0 | 4.0 |
| Cleveland | 6.75 | 4.5 | 2.6 |
| Chicago | 5.0 | 4.5 | 3.5 |

**SHEETS**—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

| Blue Annealed | Pittsburgh, Large Mill Lots | New York | Cleveland | Chicago |
|---|---|---|---|---|
| No. 10 | 2.40@2.60 | 3.78 | 3.50 | 3.75 |
| No. 12 | 2.45@2.65 | 3.83 | 3.55 | 3.80 |
| No. 14 | 2.50@2.70 | 3.88 | 3.60 | 3.85 |
| No. 16 | 2.70@2.90 | 3.98 | 3.70 | 3.95 |
| **Black** | | | | |
| Nos. 17 and 21. | 3.00@3.25 | 4.15 | 3.80 | 4.30 |
| Nos. 22 and 24. | 3.05@3.30 | 4.20 | 3.85 | 4.30 |
| Nos. 25 and 26. | 3.10@3.35 | 4.25 | 3.90 | 4.35 |
| No. 28 | 3.15@3.40 | 4.35 | 4.00 | 4.45 |
| **Galvanized** | | | | |
| Nos. 10 and 11. | 3.15@3.35 | 4.35 | 3.85 | 4.45 |
| Nos. 12 and 14. | 3.25@3.50 | 4.45 | 3.95 | 4.55 |
| Nos. 17 and 21. | 3.55@3.80 | 4.75 | 4.25 | 4.85 |
| Nos. 22 and 24. | 3.70@3.95 | 4.90 | 4.55 | 5.00 |
| No. 26 | 3.85@4.10 | 5.05 | 4.70 | 5.15 |
| No. 28 | 4.15@4.40 | 5.35 | 5.00 | 5.45 |

**WROUGHT PIPE**—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

| Steel Inches | Black | Galv. | Iron Inches | Black | Galv. |
|---|---|---|---|---|---|
| | | BUTT WELD | | | |
| 1 to 3 | 71 | 58½ | ¾ to 1¼ | 44½ | 29½ |
| | | LAP WELD | | | |
| 2 | 64 | 51½ | 2 | 39½ | 25½ |
| 2½ to 6 | 68 | 55½ | 2½ to 4 | 42½ | 29½ |
| 7 to 8 | 65 | 51½ | 4½ to 6 | 42½ | 29½ |
| 9 to 12 | 64 | 50½ | 7 to 12 | 40½ | 27½ |
| | | BUTT WELD, EXTRA STRONG, PLAIN ENDS | | | |
| 1 to 1½ | 69 | 57½ | ¾ to 1¼ | 44½ | 30½ |
| 2 to 3 | 70 | 58½ | | | |
| | | LAP WELD, EXTRA STRONG, PLAIN ENDS | | | |
| 2 | 62 | 50½ | 2 | 40½ | 27½ |
| 2½ to 4 | 66 | 54½ | 2½ to 4 | 43½ | 31½ |
| 4½ to 6 | 65 | 53½ | 4½ to 6 | 42½ | 30½ |
| 7 to 8 | 61 | 47½ | 7 to 8 | 35½ | 23½ |
| 9 to 12 | 55 | 41½ | 9 to 12 | 30½ | 18½ |

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

**WROUGHT PIPE**—Warehouse discounts as follows:

| | New York Black | New York Galv. | Cleveland Black | Cleveland Galv. | Chicago Black | Chicago Galv. |
|---|---|---|---|---|---|---|
| 1 to 3 in. steel butt welded | 65% | 53% | 60½% | 47½% | 62½% | 48½% |
| 2½ to 6 in. steel lap welded | 61% | 47% | 58½% | 44½% | 59½% | 45½% |

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

**MISCELLANEOUS**—Warehouse prices in cents per pound in 100-lb. lots:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Open hearth spring steel (base) | 4.00 | 6.00 | 4.50 |
| Spring steel (light) (base) | 6.00 | 6.00 | 6.00 |
| Coppered Bessemer rods (base) | 7.00 | 8.00 | 6.85 |
| Hoop steel | 3.78 | 3.50 | 3.48 |
| Cold rolled strip steel | 6.50 | 8.25 | 6.15 |
| Floor plates | 4.80 | 4.91 | 5.08 |
| Cold finished shafting or screw | 3.50 | 3.30 | 3.40 |
| Cold finished flats, squares | 4.00 | 3.80 | 3.90 |
| Structural shapes (base) | 2.83 | 2.66 | 2.70 |
| Soft steel bars (base) | 2.73 | 2.56 | 2.60 |
| Soft steel bar shapes (base) | 2.73 | 2.56 | 2.60 |
| Soft steel bands (base) | 3.38 | 3.06 | 3.35 |
| Tank plates (base) | 2.83 | 2.66 | 2.38 |
| Bar iron (2.25 at mill) | 2.70 | 2.21 | 2.28 |
| Drill rod (from list) | 55@60% | 55% | 50% |
| Electric welding wire: | | | |
| ⅝ | 8.00 | | 12@13 |
| ¼ | 6.50 | | 11@12 |
| 5/16 to ½ | 6.25 | | 10@11 |

## METALS

Current Prices in Cents Per Pound

| | |
|---|---|
| Copper, electrolytic (up to carlots), New York | 14.62½ |
| Tin, 5-ton lots, New York | 32.75 |
| Lead (up to carlots), St. Louis, 5.45@5.50; New York | 6.00 |
| Zinc (up to carlots), St. Louis, 6.30@6.35; New York | 7.00 |

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Aluminum, 98 to 99% ingots, 1-15 ton lots | 19.20 | 20.00 | 18.00 |
| Antimony (Chinese), ton spot | 5.50 | 7.50 | 6.25 |
| Copper sheets, base | 21.00 | 21.50@21.75 | 23.00 |
| Copper wire (carlots) | 16.50 | 17.50 | 16.25 |
| Copper bars (ton lots) | 19.50 | 22.50 | 19.50 |
| Copper tubing (100-lb. lots) | 23.75 | 24.50 | 23.00 |
| Brass sheets (100-lb. lots) | 17.75 | 19.50 | 18.75 |
| Brass tubing (100-lb. lots) | 21.50 | 22.50 | 20.50 |

# —Shop Materials and Supplies

## METALS—Continued

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Brass rods (1,000-lb. lots) | 16.25 | 17.50 | 15.75 |
| Brass wire (carlots) | 18.25 | 19.50 | ..... |
| Zinc sheets (casks) | 8.50 | ..... | ..... |
| Solder (½ and ½), (caselots) | 23.00 | 23.50 | 20.00 |
| Babbitt metal (fair grade) | 24.50 | 42.00 | 36.00 |
| Babbitt metal (commercial) | 11. 12½ | 16.00 | 9.00 |
| Nickel (ingot and shot), Bayonne, N. J. | 36.00 | ..... | ..... |
| Nickel (electrolytic), Bayonne, N. J | 39.00 | ..... | .. |

**SPECIAL NICKEL AND ALLOYS**—Price in cents per lb.

| | |
|---|---|
| Malleable nickel ingots | 45 |
| Malleable nickel sheet bars | 47 |
| Hot rolled rods, Grades "A" and "C" (base) | 50 |
| Cold drawn rods, Grades "A" and "C" (base) | 60 |
| Copper nickel ingots | 37 |
| Hot rolled copper nickel rods (base) | 45 |
| Manganese nickel hot rolled (base) rods "D"—low manganese | 54 |
| Manganese nickel hot rolled (base) rods "D"—high manganese | 57 |

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

| | | | |
|---|---|---|---|
| Shot | 32.00 | Hot rolled machined rods (base) | 48.00 |
| Blocks | 32.00 | Hot rolled rods (base) | 40.00 |
| Ingots | 38.00 | Cold drawn rods (base) | 50.00 |
| Sheet bars | 40.00 | Hot rolled sheets (base) | 45.00 |

**OLD METALS**—Dealers' purchasing prices in cents per pound:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Copper, heavy, and crucible | 12.00 | 12.00 | 12.00 |
| Copper, heavy, and wire | 11.75 | 11.00 | 11.25 |
| Copper, light, and bottoms | 9.75 | 9.50 | 10.25 |
| Lead, heavy | 4.75 | 4.50 | 4.50 |
| Lead, tea | 4.25 | 3.50 | 3.50 |
| Brass, heavy | 7.00 | 6.00 | 9.00 |
| Brass, light | 6.00 | 5.00 | 6.25 |
| No. 1 yellow brass turnings | 6.50 | 6.00 | 6.75 |
| Zinc | 3.00 | 3.25 | 3.50 |

**TIN PLATES**—American Charcoal Plates—Bright—Cents per lb.

| | | New York | Cleveland | Chicago |
|---|---|---|---|---|
| "AAA" Charcoal Melyn Grade: | | | | |
| IC, | 20x28, 112 sheets | 20.00 | 18.25 | 18.50 |
| IX, | 20x28, 112 sheets | 23.00 | 21.00 | 20.90 |
| "A" Charcoal Allaways Grade: | | | | |
| IC, | 20x28, 112 sheets | 17.00 | 16.00 | 17.00 |
| IX, | 20x28, 112 sheets | 20.00 | 18.75 | 19.60 |
| Coke Plates, Bright | | | | |
| Prime, 20x28 in.: | | | | |
| 100-lb., | 112 sheets | 12.50 | 11.00 | 14.50 |
| IC, | 112 sheets | 12.80 | 11.40 | 14.80 |
| Terne Plate | | | | |
| Small lots, 8-lb. Coating: | | | | |
| 100-lb., | 14x20 | 7.00 | 5.60 | 7.25 |
| IC, | 14x20 | 7.25 | 5.85 | 7.40 |

## MISCELLANEOUS

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Cotton waste, white, per lb. | $0.07½@$0.10 | $0.12 | $0.11½ |
| Cotton waste, mixed, per lb. | .055@.09 | .09 | .08 |
| Wiping cloths, 13½x13½, per lb. | .075 | .10 | .10 |
| Wiping cloths, 13½x20½, per lb. | .08 | .11 | .13 |
| Sal soda, 100 lb. lots | 2.80 | 2.40 | 2.65 |
| Roll sulphur, 360 lb. bbl., per 100 lb | 2.85 | 3.25 | 3.50 |
| Linseed oil, per gal., 5 bbl. lots. | .89 | 1.17 | 1.01 |
| White lead, dry or in oil | 100 lb. kegs. | New York, | 12.50 |
| Red lead, dry | 100 lb. kegs. | New York, | 12.50 |
| Red lead, in oil | 100 lb. kegs. | New York, | 14.00 |
| Fire clay, per 100 lb. bag | | .80 | 1.00 |
| Coke, prompt furnace, Connellsville | per net ton | | 14.00 |
| Coke, prompt foundry, Connellsville | per net ton | | 15.00 |

## SHOP SUPPLIES

Current Discounts from Standard Lists

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Machine Bolts: | | | |
| All sizes up to 1x30 in. | 50% | 65-10% | 60% |
| 1½ and 1½x3 in. up to 12 in. | 33⅓% | 60% | 60-10% |
| With cold punched sq. nuts | 35% | ..... | .... |
| With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%) | 40% | ..... | $4.00 off |
| Button head bolts, with hex. nuts | 25% | $3.90 net | ..... |
| Hex. head and hex. nut bolts | 30% | ..... | 65-5% |
| Lag screws, coach screws | 50% | ..... | 60-5% |
| Square and hex. head cap screws | 70-10% | 70% | 70-10% |
| Carriage bolts, up to 1 in. x 30 in. | 40% | 60-10-5% | 50-5% |
| Bolt ends, with hot pressed nuts | 50% | ..... | 55% |
| Tap bolts, (h.h. plus std. extra of 10%) | 10% | ..... | ..... |
| Semi-finished nuts ⅝ and larger | 65% | 70-10% | 80% |
| Case-hardened nuts | 60% | ..... | ..... |
| Washers, cast iron, ⅜ in., per 100 lb. (net) | $4.50 | $3.50 | $3.50 |
| Washers, cast iron, ⅝ in. per 100 lb. (net) | 3.75 | 3.50 | 3.50 |
| Washers, round plate, per 100 lb. Off list | 3.50 | 5.00 | 3.50 net |
| Nuts, hot pressed, sq., per 100 lb. Off list | 2.00 | 3.50 | 4.00 |
| Nuts, hot pressed, hex., per 100 lb. Off list | 2.00 | 3.50 | 4.00 |
| Nuts, cold punched, sq., per 100 lb. Off list | 2.00 | 3.50 | 4.00 |
| Nuts, cold punched, hex., per 100 lb. Off list | 2.00 | 3.50 | 4.00 |
| Rivets: | | | |
| Rivets, ⅞ in. dia. and smaller | 60-5% | 65-10% | 60-10% |
| Rivets, tinned | 60-5% | 65-10% | 4½c. net |
| Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net) | $4.00 | $3.50 | $3.25 |
| Cone heads, ditto (net) | 4.10 | 3.60 | 3.35 |
| 1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb | 0.25 | ..... | 0.15 |
| ⅝ in. diameter *EXTRA* | 0.15 | ..... | 0.15 |
| ½ in. diameter *EXTRA* | 0.50 | ..... | 0.50 |
| 1 in. long, and shorter *EXTRA* | 0.50 | ..... | 0.50 |
| Longer than 5 in *EXTRA* | 0.25 | ..... | 0.25 |
| Less than 200 lb *EXTRA* | 0.50 | ..... | 0.50 |
| Countersunk heads *EXTRA* | 0.35 | ..... | $3.35 base |
| Copper rivets | 55-5% | 50% | 50-% |
| Copper burs | 35% | 50% | 20% |

| | | | |
|---|---|---|---|
| Lard cutting oil (50 gal. bbl.) per gal. | $0.55 | $0.50 | $0.67½ |
| Machine lubricant, medium-bodied (50 gal. bbl.), per gal. | 0.33 | 0.35 | 0.40 |
| Belting—Present discounts from list in fair quantities (½ doz. rolls). | | | |
| Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88: | | | |
| Medium grade | 40-5% | 40-10-2½% | 50% |
| Heavy grade | 30-5% | 40% | 40-5% |
| Rubber and duck: | | | |
| First grade | 60-5% | 50-10% | 40-10% |
| Second grade | 60-10-5% | 60-5% | 60-5% |
| Abrasive materials—In sheets 9x11 in.: | | | |
| No. 1 grade, per ream of 480 sheets, Flint paper | $5.84 | $3.85 | $6.48 |
| Emery paper | 8.80 | 11.00 | 8.80 |
| Emery cloth | 27.84 | 32.75 | 29.48 |
| Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll, | 4.50 | ..... | 4.95 |
| Emery discs, 6 in. dia., No. 1 grade, per 100. | | | |
| Paper | 1.32 | ..... | 1.40 |
| Cloth | 3.02 | ..... | 3.20 |

# New and Enlarged Shops

## Machine Tools Wanted

**Cal., Los Angeles**—Bittleston Machine Shop, 335 South Los Angeles St.—tools (used).

**Cal., Los Angeles**—A. G. Litch, 102 West 38th St., (oil producer)—drill.

**Cal., Pasadena**—Foss & Jones Co., 28 East Union St.—pipe threading and cutting machines, 1-4 in.

**Conn., Bridgeport**—The Bassick Co., 38 Austin St. (manufacturer of small hardware articles), A. Greenstein, Purch. Agt. —one milling machine, shaper, power press, drill press and lathe.

**Conn., Fairfield**—G. Gibaleau, 38 Grasmere Ave.—one automatic screw machine for small radio parts.

**Conn., Milford**—S. Bathgale, 219 East Bway., (machine repairs)—small tools and electric motor ¼ hp.

**Ga., Rome**—Battery Machine Co.—one automatic circular saw gummer, 36 in.

**Kan., Wichita**—Central Electric Co., North Market Ave., J. Violette, Mgr.—one power lathe and drill press.

**Kan., Wichita**—J. Drake, c/o McKinney Auto Co., Water and 1st Sts.—drill press and lathe for power equipment.

**Kan., Wichita**—Kennedy Machine Shop, 318 East English St.—cylinder grinder for power equipment.

**Kan., Wichita**—J. Manlove, Main St., opposite Court House, (garage)—power drill press, lathe, and emery stand.

**Kan., Wichita**—M. J. S. Radio Co., 128 Loraine Ave., G. Marshall, Purch. Agt.—one power drill press, lathe, belting, shafting, hangers, pulleys and emery stand.

**Kan., Wichita**—R. W. Reynolds, 315 South Frances St.—power drill press, lathe, emery stand, cylinder grinder, and belting for garage.

**Md., D. C., Washington**—H. B. Schmidt, P. O. Box 208, Penn Ave. Sta.—power lathe and chucking machine.

**Mich., Detroit**—M. C. Cummings, 250 East Warren Ave.—one band saw and equipment 26 or 30 in.

**Mo., Kansas City**—M. J. Lawrence, 3250 Michigan Ave.—tinsmith tools, sitting down machine, burring machine, crimper and beader.

**Mo., Kansas City**—A. B. Scrap Iron & Metal Co., 2036 Central St., manufacturer of iron and pipe—pipe threading machine 1 to 6 in.

**Mo., Pleasant Hill**—Quick Set Chain Co. —shearing machine, power hammer, drill press, emery stand, line shafting, pulleys, hangers, belting, bearings, and 10 hp. motor.

**N. Y., Brooklyn**—F. J. Gleason, 1552 Bergen St.—eyeletting machine.

**N. Y., Buffalo**—Allan Mfg. & Welding Co., Inc., 726 Washington St.—one electric floor base grinder and electric portable grinder.

**N. Y., Buffalo**—New York Telephone Co., Telephone Bldg., Church St., C. H. Thomas, Purch. Agt.—equipment for repairing automobiles and trucks, and two 1,000 gal. gas tanks and pumps, for proposed garage on Jefferson and Delevan Aves.

**N. Y., Caywood**—J. Boorom—one automatic vertical type shingle saw.

**N. Y., Geneva**—W. L. Packard—one or more chucks, 18 to 30 in. in diameter for use on lathes.

**N. Y., New York**—Cornell Iron Wks., 601 West 26th St.—twist drill grinder for medium size drills.

**O., Canton**—National Pressed Gear Co., Inc., 222 Cleveland Ave., H. Nusbaum, Secy.—machinery and equipment for proposed drop forged gear plant, including equipment for foundry and machine shop.

**O., Lima**—Lima Locomotive Wks., South Main St.—machinery and equipment for truck house, erecting shop, super-heating plant, store room, paint and truck shops.

**O., Toledo**—The Toledo Machine and Tool Co., 1736-44 Dorr St.—shears for cutting up scrap rail.

**O., Youngstown**—Vahey Oil Co., 1028 West Rayen St.—machinery, tools and equipment for garage and service station.

**Pa., McKeesport**—The Bd. of Educ.—one band saw and electric drill.

**Pa., New Galilee**—Pittsburgh, Lisbon & Western Ry., N. B. Billingsley, Vice Pres. & Genl. Mgr.—machinery and equipment for locomotive repair and blacksmith shop.

**Pa., Oil City**—Bd. of Educ.—machine and woodworking shop equipment for high school.

**Pa., Phila.**—G. W. Blabon Co., 21st and Huntingdon Sts.—additional machinery for the manufacture of oil cloth, also additional equipment for machine shop.

**Pa., Phila.**—Fox Gun Co., 18th and Windrim St.—boring machines, lathes, planers, etc.

**Pa., Pittsburgh**—Pittsburgh Rys. Co., Phila. Co. Bldg., 6th Ave.—2 lathes, 2 drill grinders, and 1 bench drill.

**Pa., Topton**—Topton Fdy. Co., N. Kline, Prop.—machine shop equipment.

**Va., Richmond**—The City Fire Dept., c/o A. Heckman, Dept. of Public Safety—large lathe.

**Va., Richmond**—A. J. Lucas, 2112 East Main St., sheet (metal works)—sheet metal machinery (prices).

**Va., Richmond**—Mann & Mathis, 202 North 5th St., watchmakers—one lathe with motor and one polishing lathe with motor.

**Va., Richmond**—H. C. Richardson, 1918 East Franklin St.—one drill press, electric drill, and bench tools for auto repair shop.

**Va., Richmond**—Richmond Typewriter Co., 24 North 7th St.—small lathe.

**Va., Richmond**—Strickland Machine Shop, 2322 East Main St.—lathe and drill press.

**Va., Richmond**—Virginia Machine Shop, 2218 East Main St.—planer and milling machine.

**Wis., Appleton**—G. R. & S. Motor Co., 738 Washington Ave.—machinery for proposed auto repair shop.

**Wis., Eagle River**—Strong & Manley—machinery for auto repair shop including compressor and gas storage tank.

**Wis., Milwaukee**—Automotive Service Co., 1008 29th St., A. C. Lauer, Purch. Agt. —battery charging machine and drill press.

**Wis., Milwaukee**—S. P. Jack, 597 Lincoln Ave.—automobile repair machinery, including drill press and air compressor.

**Wis., Racine**—Knudsen Sales Co., c/o A. C. Knudsen, 1734 Michigan Blvd.—general line of automobile repair machinery.

**Wis., Wausau**—Marathon Motor Co., 210 McClellan St.—machinery and equipment for proposed auto repair shop.

## Machinery Wanted

**Ala., Magazine**—Alabama Saw Mills—machinery to replace that which was destroyed by fire.

**Cal., Los Angeles** — L. R. Cook, 2107 Woolam St.—harness making machinery and loom for weaving.

**Cal., Los Angeles** — Universal Paper Goods Co., 422 Boyd St., L. E. Bartels, Purch. Agt.—paper making machinery, printing press, belting, paper cutter, pulleys, hangers, and bearings.

**Cal., Turlock** — Hunt-Jewett-Bontz Co., (California Sweet Potato Corp.)—about $275,000 worth of machinery for alcohol and vinegar plant on South 1st St.

**Fla., Ft. Meade**—Ft. Meade Citrus Packing Co., C. H. Walker, Pres.—machinery and equipment for citrus packing plant.

**Ill., Chicago**—The Clemetsen Co., 3401 West Division St., D. A. Raggio, Purch. Agt. —power printing press for job work (used).

**Ill., Chicago**—F. Riebel & Co., 6217-21 Wentworth Ave.—machinery for the manufacture of cans, also seaming machine (used).

**Kan., Kansas City**—Kansas City Second Hand Box Co., 32 Ewing St.—one power planer.

**Kan., Wichita**—F. E. Church, 206 North Main St., Room 8—job printing press.

**Kan., Wichita**—Franklin Printers, 324½ East Douglas Ave., E. Operman, Purch. Agt.—job press and Miller feeder, for power equipment.

**Kan., Wichita**—C. H. Luling, 223 North Market St., (oil producer)—drill rig.

**Kan., Wichita**—Peerless Steam Laundry, 243 North Market St.—collar laundrying machine (power).

**Kan., Wichita**—H. C. Pershing & Co., 618 South Water St.—job press with power equipment.

**Md., Baltimore**—Burnot Fire Proofing Products Co., W. E. Semans, Pres.—equipment and machinery for the manufacture of fireproof roof products, etc.

**Mich., Detroit**—Detroit Marvel Brass Mfg. Co., 1742 Rivard St.—machine equipment for finishing small brass products.

**Minn., Minneapolis**—W. Guttman, 558 8th Ave., N.—refrigerating machine for proposed creamery.

**Minn., St. Paul**—Tilden Produce Co., 65 East 3rd St., W. A. Tilden, Pres.—creamery and refrigerating machinery equipment.

**Mo., Joplin**—Joplin Fdry. Co., East 7th St., C. Bowers, Purch. Agt.—two chain hoists for 1 and 3 ton.

**Mo., Kansas City**—C. E. Meyers, 543 Westport Ave., cabinet maker—band saw.

**N. J., Camden**—C. W. Brennan & Co., 6th and Jefferson Rd., manufacturer of shade cloth, W. H. Jacobs, Purch. Agt.—looms, dryers, impregnators, etc.

**N. J., Camden**—Honor Knitting Mills, Inc., 216 Federal St., E. F. Price, Purch. Agt.—latch needle machines, full fashion hosiery machines, belting, pulleys, etc.

**N. J., Camden**—U. S. Wool Combing Co., 9th and State Sts., J. A. Middleton, Purch. Agt.—additional wool cards, combs, and accessories.

**N. J., Union Hill** (Weehawken P. O.)—A. Van Goethen, 22 Hudson Ave. (engineers)—one Worthington receiver.

**N. Y., Buffalo**—L. F. Lindall, Atty., Erie County Bank Bldg., (representing Champion Rotary Motors, Inc.)—machinery and equipment for large plant to be established here, for the manufacture of rotary auto engines.

**N. Y., Gasport**—Gasport Fruit Growers Assn.—machinery and equipment for large fruit packing and storage plant under construction at Orangeport.

**N. Y., Jamestown**—Jamestown Worsted Mills, 335 Harrison St.—machinery for combing and drawing departments.

**N. Y., Mayville**—Chautauqua Cabinet Co. —additional machinery for proposed increase in capacity of plant.

**N. Y., New York**—J. Cassella, 134 West 37th St.—one hand loom (new or used).

**N. Y., Niagara Falls**—Carborundum Co., Buffalo Ave. and 18th St.—one hydraulic press, pressing space 3 ft. 10 in. x 3 ft. 10 in., pressure 5,000 to 6,000 lbs. (used).

**N. Y., Oneonta**—Oneonta Battery Co., 24 Broad St.—complete equipment for battery service and repair department.

**N. Y., Rochester**—Powertown Tire Corp., Ridgeway Ave.—equipment for proposed tire station including vulcanizing equipment.

**N. Y., Rochester**—E. J. Protopapas, 570 Lyell Ave.—machinery for the manufacture of ice cream.

**N. Y., Rochester**—Umbsen Mfg. Corp., 155 Sanford St., R. E. Chesher, Secy.—machinery and equipment for the manufacture of patented eye spray, for proposed branch plant at San Francisco, Cal.

**N. Y., Saratoga Springs**—Bd. of Educ., C. L. Mosher, Secy.—machinery and equipment for woodworking and machine shops in new high school.

**N. Y., Solvay**—Bd. of Educ.—machinery and equipment for vocational department of new high school.

**N. C., Lexington**—C. M. Wall & Son—woodworking machinery for box factory and planing mill, including jointers, sanders, tenoners, matches, etc.

**O., Ashland**—F. E. Myers & Bro.—equipment for (proposed) large foundry addition.

**O., Conneaut**—J. L. Lovell—portable drilling equipment for either gas or oil well work.

**O., Fremont**—Hodes-Zinc Co., (manufacturer of automobile equipment and accessories)—machinery and equipment for proposed plant at Erie, Pa.

**O., Williamsburg**—Williamsburg Furniture Co., J. F. Knight, Purch. Agt.—full line of woodworking machinery to replace that destroyed by fire.

**Okla., Oklahoma City**—Apco Refining Co., Colcord Bldg.—equipment for proposed refinery, 700 bbls. daily capacity.

**Pa., Corry**—Kurtz Brass & Wood Bed Co.—machinery for proposed addition to manufacturing plant.

**Pa., East Stroudsburg**—Weeds Ice Cream Co.—complete machinery and equipment for the manufacture of ice cream, for (proposed) large plant on King St.

**Pa., Garland (Warren County)**—Grove Mfg. Co., Inc., manufacturer of furniture—additional woodworking machinery for proposed increase in capacity of plant.

**Pa., Herrick Center**—Bd. of Educ., G. B. Giles, Secy.—mechanical equipment for high and grade school, and vocational shop.

**Pa., Phila.**—Boger & Crawford, J and Venango Sts., (manufacturer of yarns)—R. C. Boger, Purch. Agt., additional equipment including cards, garnetts, etc., for mills at Lincolnton, N. C.

**Pa., Phila.**—Breyer-Sharpless, Inc., 8th and Cumberland St.—refrigerating and wrapping machines, also ice breakers, power freezers, steam vats, etc.

**Pa., Phila.**—Corrugated Container Co., Trenton and Venango Sts.—Colt or Thompson cutter and creaser over 20 x 30 in.

**Pa., Phila.**—Fay-Keser & Sailer, Inc., Front and Clearfield Sts., manufacturers of hosiery, F. B. Keser, Purch. Agt.—additional knitting machines and looper machines.

**Pa., Phila.**—Globe Knitting Mills, 2nd St. and Columbia Ave.—additional machinery including full fashion hosiery machine and latch needle machine.

**Pa., Phila.**—C. Gurevitch, 1214 South 24th St.—one large stationary circular saw with table.

**Pa., Phila.**—La France Textile Co., 4423 Frankford Ave., manufacturer of tapestries, E. T. Duval, Purch. Agt.—additional Jacquard looms.

**Pa., Phila.**—Oliver Knitting Mills, 3rd and Huntington Sts.—full fashion hosiery machines, latch needle machines, ribbers and accessories.

**Pa., Phila.**—Paragon Knitting Mills, 2813 Fletcher St., N. Neuman, Purch. Agt.—additional knitting and sewing machines.

**Pa., Phila.**—Penna. Music Co., 13th and Appletree Sts.—presses, paper cutter, folders, etc.

**Pa., Pottstown**—Collegeville Flag & Mfg. Co.—complete machinery and equipment, including stitchery, etc., for proposed plant for the manufacture of flags.

**Pa., Scranton**—Clark-Snover Tobacco Co., 112 Adams Ave., W. L. Mathews, Pres.—additional machinery and equipment for plant on Dockash St.

**Pa., Temple**—S. S. Staley—complete equipment for proposed foundry.

**Pa., Vandergrift**—The Bd. of Educ.—machinery and equipment for vocational department of proposed high school.

**Pa., Warren**—East Side Bakery, 209 Penna. Ave. E., J. P. Raisor—bakeshop equipment.

**Pa., Williamsport**—W. R. Hoehn Silk Co., 201 Pine St.—machinery for proposed addition to silk factory.

**S. C., Lena**—H. L. Lawton—machinery for the manufacture of crates and baskets.

**S. C., Norway**—S. S. Williams—machinery to equip small canning factory.

**Tenn., Erwin**—B. S. Abernethy, Lincolnton, N. C., and W. C. Heath, Charlotte, N. C.—machinery for proposed 15,000 spindle textile mill at Erwin, Tenn.

**Tex., Beaumont**—Boykin Mchy. & Supply Co.—one 48 in. x 48 in. x 12 ft. motor driven planer, also one alligator shear.

**Tex., Brady**—Mayhew Produce Co.—machinery and equipment for proposed cold storage and refrigerating plant.

**Tex., Breckenridge**—Dillingham Ice Cream Co.—machinery and equipment for proposed 65 ton ice manufacturing plant.

**Tex., Killeen**—W. J. Cole, (oil producer)—oil pumps and large oil tanks.

**Vt., Barre**—Nelson & Berg, (granite products)—machinery and equipment for proposed monumental works on Lincoln and School Sts., Auburn, N. Y.

**Va., Dante**—Nora Coal Corp., J. W. Gerow, Pres. and Mgr.—complete line of mining machinery.

**Va., Norfolk**—M. T. Blassingham Lumber Co., Flat Iron Bldg.—woodworking machinery for small planing fill on 25th St.

**Va., Richmond**—Fleming Aytes, 1006-A Bacon St., manufacturer auto part patent—special machinery.

**Va., Richmond**—J. Fox & Son, 25th and Franklin Sts., (mill work)—one sash sticker.

**Va., Roanoke**—Journal Printing & Publishing Co., W. R. Martin, Mgr. and Pres.—machinery and equipment for printing plant, including 7 column press and linotype machine (used).

**Va., Tamworth**—Moon & Blanton—full line of machinery for a creamery.

**W. Va., Charleston**—Moore Lumber Co., J. W. Moore, Pres.—one 7 ft. band mill, log locomotive, logs trucks, and 25 lb. relaying rails.

**W. Va., Paw Paw**—Bd. of Educ., C. R. White, Secy.—equipment for vocational department of new school.

**Wis., Fredonia**—Gilson Bros.—foundry equipment, including cupola and molding machines.

**Wis., La Crosse**—Nelson Garment Co., 111 South 2nd St.—stitching and buttonhole machines for proposed factory.

**Wis., Madison**—The Bd. of Educ., c/o Secretary—machinery and equipment for manual arts and vocational training building.

**Wis., Madison**—The Way Building Co., 20 North Orchard St.—woodworking machinery for new carpenter shop.

**Wis., Marinette**—Heath Cedar Co., 1863 Riverside Ave.—belting, shafting and hangers for factory addition.

**Wis., Milwaukee**—Byrne Bros. Co., 3112 Burleigh St.—air compressor, gasoline storage tank, and pump for proposed garage on Kinnickinnie Ave.

**Wis., Milwaukee**—Edward Motor Car Co., 2713 Grand Ave.—machinery for repair shop including conveyor, motors, etc.

**Wis., Milwaukee**—C. Kirchhan, 823 47th St.—foundry moulding machines.

**Wis., Milwaukee**—J. L. Shonts, 449 21st St., manufacturer of meat products—one No. 52 chopping and stuffing machine, one meat grinding machine (both power driven).

**Wis., Milwaukee**—J. Zaph, 1341 40th St., (millwork)—one 6 in. sticker.

**Wis., Neenah**—Jaeger-Dowling Co., 214 South Commercial St.—air compressor, storage tank, pump and machinery for auto repair shop.

**Wis., Phillips**—Kneeland McClurg Co.—machinery for sawmill including saws, etc.

**Wis., Port Washington**—Port Washington Beverage Co., c/o J. W. Collins—bottling machinery.

**Wis., Rosendale**—Central Wisconsin Canning Co.—machinery for proposed canning plant, including conveying machinery.

**Wis., Stevens Point**—B. V. Martin, 1303 Main St.—one 6 to 8 in. sticker, double drum sander, medium size planer, hollow chisel mortiser, glueing machine and electric motors.

**B. C., Kamloops**—Northern Construction Co.—prices on new saw mill machinery and equipment for mill on Thompson River.

**Ont., Listowel**—N. Calder—woodworking equipment for new planing mill including planers, shapers, saws, etc.

**Ont., Rhamesville**—D. E. Wallace—prices on complete new equipment for sawmills which were recently destroyed by fire. Damage to machinery, $25,000.

**Ont., St. Marys**—The Hurlbut Shoe Co.—special equipment for shoe factory.

**Ont., Stratford**—Dufton Woolen Mills Co.—machinery and equipment for woolen mill, partially destroyed by fire.

## Metal Working Shops

**Cal., Oakland**—Chevrolet Motor Co. of California, 69th Ave. and Foothill Blvd., had plans prepared for the construction of an addition, for the manufacture of auto bodies. Estimated cost $150,000. Architect not announced.

**Cal., San Francisco**—Eames Co., 55 1st St., manufacturer of hand trucks and wheel goods, has awarded the contract for the contruction of a 1 story factory on Howard and 5th Sts.

**Ind., Hartford City**—Paramount Wheel & Eng. Co. plans to build a 1 story wheel factory. Estimated cost $100,000. Private plans.

**Mich., Detroit**—A. Kahn, Archt., 1,000 Marquette Bldg., is receiving bids and will open same about Aug. 15, for the construction of a 5 story, 60 x 441 ft. factory (for the manufacture of auto parts) and two connecting bridges to existing building on Campau Ave., for Studebaker Corp., Brush St. and Piquette Ave. Estimated cost $400,000.

**N. J., Perth Amboy**—The Standard Underground Cable Co., 50 Church St., New York City, has awarded the contract for the construction of a 3 story, 50 x 150 ft. factory, on Washington St., here. Noted June 15.

**N. Y., L. I., Morris Park**—The Long Island R. R. has awarded the contract for the construction of shop buldings, consisting of a 3 story, 40 x 100 ft. warehouse and a 3 story, 40 x 80 ft. factory, here. L. V. Morris, Ch. Engr.

**N. Y., New York**—O. K. Building Corp., c/o J. De Hart, Archt. and Engr., 1039 Fox St., is having plans prepared for the construction of a 1 story, 110 x 135 ft. garage on Bryant Ave. and 161st St. Estimated cost $50,000.

**N. Y., New York**—The Schock Estate has awarded the contract for the construction of an 8 story, 75 x 100 ft. garage and service station at 503 West 56th St.

**O., Cleveland**—Cleveland Folding Machine Co., 5200 Euclid Ave., has awarded the contract for the construction of a 2 story, 96 x 180 ft. factory, on East 61st St. near Euclid Ave. Estimated cost $75,000. E. H. Jones, Secy.

**O., Cleveland**—M. Marmorstein, Ulmer Bldg., had plans prepared for the construction of a 1 story, 40 x 94 ft. garage on East 69th St. and Euclid Ave. Estimated cost $40,000. W. S. Ferguson Co., 1900 Euclid Ave., Archts.

**O., Cleveland**—D. Round & Son, Stop 3, A. B. C., have awarded the contract for the construction of a 2 story, 52 x 275 ft. foundry and shop. Estimated cost $60,000.

**O., Youngstown**—Vahey Oil Co., 1028 West Rayen St., plans to build a 2 story, 75 x 162 ft. garage and service station on Phelps and Front Sts. Estimated cost $65,000. Architect not announced.

**Pa., Ambridge**—The Amer. Bridge Co. has awarded the contract for the construction of an addition, including a large crane runway and unloading dock. Estimated cost $15,000.

**Pa., Monessen**—S. S. Jones, 30 6th St., Belle Vernon, is receiving bids for the construction of a 2 story, 64 x 99 ft. garage on Doner Ave. and 9th St., here. Estimated cost $60,000. Austin Co., Union Arcade, Pittsburgh, Archts. and Engrs.

**Pa., Munhall**—The Miller Motor Co., 228 West 7th Ave., Homestead, Pa., is receiving bids for the construction of a 2 story, 74 x 108 ft. garage, on 8th Ave., here. Estimated cost $40,000. J. E. Dwyer, 5808 Forbes St., Pittsburgh, Archt.

**Pa., Phila.**—A. H. Fox Gun Co., 18th and Windrim Sts., has awarded the contract for the construction of a 1 story, 100 x 100 ft. gun factory.

**Pa., Phila.**—National Biscuit Co., 13th St. and Glenwood Ave., has awarded the contract for the construction of a 1 story 132 x 225 ft. garage.

**W. Va., Montgomery**—Coal Valley Machine and Electric Mine Car Co. has awarded the contract for the construction of a 1 story, 50 x 100 ft. factory.

**W. Va., Wheeling**—The National Garage of Wheeling will build a 2 story, 103 x 112 ft. garage on National Pike. Estimated cost $50,000.

**Wis., Appleton**—G. R. & S. Motor Co., 738 Washington Ave., and E. A. Wettengel, Archt., 578 Pierce Ave., are receiving bids for the construction of a 1 story, 32 x 100 ft. garage and repair shop. Estimated cost $40,000. Noted July 20.

**Wis., Eagle River**—Strong & Manley had plans prepared for the construction of a 1 story, 120 x 130 ft. garage. Estimated cost $45,000. Private plans.

**Wis., Fredonia**—Gilson Bros. plan to build a 1 story, 36 x 120 ft. foundry. Estimated cost $45,000. Architect not selected.

**Wis., La Crosse**—McKenzie Mfg. Co., 1648 Liberty St., will build a 2 story, 36 x 140 ft. factory addition for the manufacture of potato sprayers and diggers. Estimated cost $35,000.

**Wis., Milwaukee**—Byrne Bros. Co., 3112 Burleigh St., receiving bids and opens same about Aug. 14, for the construction of a 1 story, 58 x 180 ft. garage on Kinnickinnie Ave. Estimated cost $40,000. Private plans.

**Wis., Milwaukee**—Edward Motor Car Co., 2713 Grand Ave., has awarded the contract for the construction of a 2 story, 108 x 200 ft. garage, on Grand Ave. and 36th St. Estimated cost $100,000.

**Wis., Milwaukee**—M. Froehlig, 779 6th St., has awarded the contract for the construction of a 1 story, 50 x 125 ft. garage, on Center and 29th Sts. Estimated cost $40,000.

**Wis., Milwaukee**—Harley-Davidson Motor Co., 3732 Chestnut St., has awarded the contract for the construction of a 1 story, 74 x 128 ft. factory addition. Estimated cost $40,000.

**Wis., Neenah**—Jaeger-Dowling Co., 214 South Commercial St., is receiving bids and will open same about Aug. 14, for the construction of a 1 story, 75 x 120 ft. garage on North Commercial Ave. Estimated cost $45,000. Private plans.

**Wis., Wausau**—Marathon Motor Car Co., 210 McClellan St., has awarded the contract for the construction of a 4 story, 60 x 120 ft. garage addition. Estimated cost $80,000.

## General Manufacturing

**Fla., Lake Eustis**—Lake Eustis Fruit Co. plans to build a 75 x 100 ft. fruit canning factory. Estimated cost including machinery, $10,000. B. Dillard, Mgr. Architect not selected.

**Fla., Tampa**—Consumers Ice Co., Polk and Marion Sts., will receive bids until Oct. 1, for the construction of a 1 story, 75 x 125 ft. ice plant. Estimated cost including machinery $20,000. C. Perry, Mgr. Architect and Engineer not announced.

**Ill., Chicago**—Pratt & Lambert, Inc., 320 West 2th St., has awarded the contract for the construction of a 2 story, 50 x 150 ft. factory, for the manufacture of varnish and paint, on 26th St. near Princeton Ave. Estimated cost $60,000.

**Ind., Hammond**—Calumet Baking Co. has awarded the contract for the construction of an addition to its plant. Estimated cost $50,000.

**Ind., Indianapolis**—The Gem Laundry Co., 241 Indiana Ave., plans to build a 2 story, 67 x 202 ft. laundry on North Senate Ave. Estimated cost $40,000. W. H. Albersmeier, 508 Rauh Bldg., Archt.

**Ind., Indianapolis**—United Brotherhood of Carpenters and Joiners of America plans to build a 3 story print plant on East Michigan Ave. Estimated cost $100,000.

**Ky., Summit**—Pittsburgh Brick & Tile Co., c/o S. S. Willis, Ashland, plans to build a plant here for the manufacture of bricks. Estimated cost $200,000. Private plans.

**Me., Sanford**—The Sanford Mills has awarded the contract for the construction of a 6 story, 110 x 253 ft. spinning mill and a 4 story 85 x 155 ft. finishing building.

**Mass., Fall River**—Amer. Thread Co., (Kerr Mills), has awarded the contract for the construction of a 2 story addition to its mill, containing 54,000 sq.ft. of floor space. Estimated cost $125,000.

**Minn., Duluth**—Universal Portland Cement Co., 202 Wolvin St., will increase the capacity of plant No. 7. Plans include 200 ft. kiln for burning raw material, dust collecting apparatus and other equipment. Estimated cost $200,000.

**Mo., Kansas City**—The City will hold an election in November to vote on $100,000 to $150,000 bonds for improving Leeds Farm, including the construction of east wing of building, and an electric plant, installing hospital for drug addicts, refrigerating plants, and laundry for men and womens buildings.

**N. J., Camden**—C. W. Brennan, 1306 Sansom St., Phila., has awarded the contract for the construction of a 4 story, 40 x 200 ft. factory, for the manufacture of cloth, on 6th and Jefferson Sts., here.

**N. Y., Buffalo**—Lautz Marble Corp. 861 Main St., has awarded the contract for the construction of a 1 story, 110 x 142 ft. manufacturing and office building.

**N. Y., Jamestown**—Jamestown Worsted Mills, 335 Harrison St., has awarded the contract for the construction of a 4 story, 70 x 175 ft. addition to its combing and drawing department, and a 122 x 180 ft. dye and filter house, etc. Estimated cost $100,000.

**N. Y., Owego**—Gotham Shoe Co., plans to build a factory addition on Church St.—Estimated cost $50,000. Architect not announced.

**N. C., Winston-Salem**—Fogle Furniture Co. is having plans prepared for the construction of a 2 story, 50 x 125 ft. furniture factory. Estimated cost $30,000. F. A. Fogle, Pres. and Mgr.

**O., Cleveland**—The Ingraham Waste & Supply Co., 1539 Columbus Rd., is receiving bids for the construction of a 1 story, 50 x 125 ft. factory and warehouse at 1450 Hamilton Ave. Estimated cost $50,000. W. E. Monsor, Pres. Poe Eng. Co., Peoples Bank Bldg., Engrs. Noted July 27.

**O., Cleveland**—The Standard Envelope Co., 1011 Oregon Ave., has awarded the contract for the construction of a 1 story, 155 x 200 ft. factory on East 30th St. and Chester Ave. Estimated cost $100,000, G. H. Altman, Pres. Noted July 13.

**O., Columbus**—Clark Show Case Co., 31 West Chestnut St., is having plans prepared for the construction of a 4 story, 40 x 120 ft. factory, on Naghten St. Estimated cost $80,000. Private plans.

**O., South Akron (Akron P.O.)**—Washington Rubber Co. (manufacturer of rubber specialties, plans to rebuild large portion of its factory which was destroyed by fire.—Estimated cost $50,000. Architect not announced.

**Pa., Butler**—Standard Plate Glass Co., near Lincoln Ave., will build a 1 story, 100 x 250 ft. addition to its glass factory.—Estimated cost $100,000. Private plans.

**Pa., Phila.**—Penna Music Lithograph Co., 13th and Appletree Sts., has awarded the contract for the construction of a 1 story, 50 x 85 ft. printing plant. Estimated cost $11,000.

**Pa., Warren**—Crescent Furniture Co. plans to build a 4 story, 50 x 82 ft. addition to its furniture factory also 36 x 50 ft. dry kilns, on South Side. Estimated cost $20,000. Architect not announced.

**Pa., Williamsport**—W. R. Hoehn Silk Co., 201 Pine St., has awarded the contract for the construction of a 1 story addition to its silk factory.

**Pa., Williamsport**—Williamsport Building Products Co., c/o E. Dittmar, Archt., 1603 Erie Ave., had plans prepared for the construction of a 1 story, 57 x 160 ft. factory for the manufacture of building products.

**S. C., Beaufort**—Beaufort Gazette is havplans prepared for the construction of a 1 story, 50 x 100 ft. publishing plant. Estimated cost with machinery $16,000. S. F. Sherman, Mgr.

**S. C., Greenville**—Norris Bros., Inc., Birnie St., have awarded the contract for the construction of a 2 story, 40 x 128 ft. bobbin factory.

**S. C., Greer**—Victor-Monaghan Co., Victor Plant, has awarded the contract for the construction of a 2 story addition to its cloth room building.

**S. C., Sumter**—Sumter Ice & Fuel Co. plans to build a creamery and ice plant. Estimated cost $30,000 to $40,000. E. H. Moses, Mgr. Architect not selected.

**Tenn., Erwin**—B. S. Abernethy, Lincolnton, N. C., and W. C. Heath, Charlotte, N. C., plan to build a 15,000 spindle textile mill here. Architect not announced.

**Tenn., Nashville**—Marshall & Bruce Printing Co., 162 4th Ave., N., is having plans prepared for the construction of an office and general printing plant on 9th and Berryhill Sts.—Estimated cost $150,000. Freeland, Roberts & Acker, Independent Life Bldg.,—Engrs., Hart & Nevins, Watkins Bldg., Archts.

**Va., Petersburg**—G. W. Koiner is at head of a company which plans to build a 5 story, 150 x 200 ft. cold storage plant. Estimated cost $1,000,000. Architect not announced.

**Wash., Tacoma**—The Carstens Packing Co., Tide Flats, is having plans prepared for the construction of a 4 story, 67 x 72 ft. packing plant addition with 32 x 40 ft. wing. Estimated cost $1,000,000. P. V. Cornils company Archt.

**W. Va., Warwood (Wheeling P.O.)**—Wheeling Oxygen Co., Wheeling, plans to build an oxygen plant on 16th St., S.S., here. Industrial Eng. Co., Park Bldg., Pittsburgh, Pa., Engrs.

**Wis., Appleton.**—The Valley Dairy Co.—plans to build a 2 story, 60 x 100 ft. dairy.—Estimated cost $50,000. Architect not selected.

**Wis., Green Bay**—The Northern Paper Mills Co., Madison and Day Sts., c/o K. McNaughton, Purch. Agt., plans to build a 2 story, 70 x 200 ft. addition to its mill. Estimated cost $100,000. Architect not selected.

**Wis., Madison**—The Bd. of Educ., c/o Secretary, has awarded the contract for the construction of a 2 story, 60 x 185 ft. manual art and vocational training building. Estimated cost $75,000. Noted July 27.

**Wis., Madison.**—J. Feldman Paper Box Co., 515 Regent St., is having plans prepared for the construction of a 1 story, 60 x 182 ft. box factory on Charter St. Estimated cost $100,000. J. R. and E. J. Law, Strand Theatre, Archts. Noted Feb. 2.

**Wis., Milwaukee**—Holeproof Hosiery Co., 404 Fowler St., has awarded the contract for the construction of a 4 story, 64 x 64 ft. textile mill addition on 5th St. Estimated cost $60,000.

**Wis., Milwaukee** — Standard Victoria Steam Laundry, 69 Ogden Ave., will receive new bids (former bids rejected) for the construction of a 2 story, 40 x 114 ft. laundry. Lesser & Schutte, 82 Wisconsin St., Archts.

**Wis., Phillips**—Kneeland McClurg Co. has awarded the contract for the construction of a 1 story, 60 x 210 ft. saw mill, to replace one destroyed by fire. Estimated cost $75,000. P. S. McClurg, Pres. Noted July 13.

**Wis., Rosendale**—Central Wisconsin Canning Co. is having plans prepared for the construction of a 2 story canning plant comprising a main building, warehouse and viner. Estimated cost $100,000. J. R. Hatch, Secy. Private plans.

**Wis., Waukesha**—Manitowoc Church Furniture Co., 1214 Lincoln Ave., has awarded the contract for the construction of a 1 story, 70 x 90 ft. factory. Estimated cost $50,000.

**Mex., Tampico**—Pierce Oil Corp. plans to rebuild portion of its refinery which was recently destroyed by fire. Estimated cost $100,000. Engineer not announced.

**N. B., St. Johns**—Nasgwak Paper Mills Ltd. plans to build an addition to its paper plant, to increase its daily capacity from 60 to 80 ton. Estimated cost $500,000. Private plans.

**Ont., Aurora**—Taylor Rubber Co., 37 Richmond St., E., Toronto, plans to build an auto tire factory on Yonge St. here. Estimated cost $300,000. Architect not selected.

**Ont., Fort William**—Fort William Paper Mills is having plans prepared for the construction of a paper mill on Mission St. Estimated cost $300,000. Private plans.

**Ont., St. Marys**—The Hurlbut Shoe Co. has awarded the contract for the construction of a 3 story, 50 x 60 ft. shoe factory at Cadzow Park. Estimated cost $65,000. Noted May 4.

**Ont., Stratford**—Dufton Woolen Mills Co. plans to rebuild that part of its mills which was destroyed by fire.

**Ont., Trenton**—The Dominion Combing Mills, Ltd., 709 Continental Life Bldg., Toronto, has awarded the contract for the construction of a 1 and 2 story wool combing and washing plant. Estimated cost $200,000.

**Ont., Welland**—Maple Leaf Milling Co. plans to rebuild its 5 story flour and grain mill, whch was destroyed by fire.